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Assuring the quality of early childhood education (ECE) settings is a fundamental consideration for supporting young children's learning and development. Head Start programs serve children and families living in poverty, highlighting the need for equitable and high-quality learning opportunities for these vulnerable populations, and the ECE workforce characteristics are foundational considerations for providing quality care and education. However, the existing literature has yielded mixed results regarding the association between teacher characteristics and classroom quality. Furthermore, the administrative staff within the ECE settings have been a relatively neglected area within inquiries into ECE quality.

The current study aimed to explore Head Start teachers' and center directors' characteristics as predictors of classroom quality using data from the Head Start Family and Child Experiences Survey (FACES) 2014 data with hierarchical linear modeling (HLM) approach. The analysis sample consisted of 302 centers/directors and 692 classrooms/teachers. Selected survey questions from Core Teacher and Core Center Director surveys and classroom observation scores from the CLASS measure were used as the study variables.

Regarding teachers' characteristics, level of education demonstrated negative associations with CLASS Emotional Support and Classroom Organization scores. In addition, as the teachers experienced increased coaching/mentoring support, the Classroom Organization scores decreased. With respect to center directors' characteristics, the results indicated significant moderations for the associations between teachers' professional development (PD) experiences and classroom quality scores. As the directors had higher levels of education (i.e., graduate degrees), ECE/Child Development-related degrees, higher years of experience, and

more workload related to teachers, the CLASS scores were higher, despite the teachers' decreased in-service PD experiences. On the contrary, for the directors who felt more challenged regarding their managerial duties, the teachers' increased in-service PD experiences were positively associated with classroom quality scores. The overall results, along with a discussion of the implications, shed light on the potential roles of teachers' in-service PD experiences and center directors' characteristics on classroom quality across Head Start centers.

EXAMINING CLASSROOM QUALITY IN HEAD START IN RELATION TO TEACHERS' AND CENTER DIRECTORS' CHARACTERISTICS: A MULTILEVEL APPROACH

by

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CHAPTER I: INTRODUCTION

In the 1960s, as women started to enter the workforce, needs for non-maternal early care and education (ECE) grew. Parallel to these growing ECE needs, governments and policymakers took action to establish systems considering their target population, countries' values, and governmental structures (Gomez et al., 2015; Harding et al., 2019A). With the increasing ECE services around the world, including the United States, the need for examining the quality of these settings has been a particular interest for the ECE professionals.

Among these contextually situated ECE efforts, Head Start is one of the most significant federal ECE programs in the United States. It was established in 1965, after President Lyndon B. Johnson's declaration for "war on poverty," as an initiative to support children who faced poverty. Since then, Head Start has been the largest publicly funded preschool program to support children and families from low-income populations. Head Start has many intended outcomes such as supporting children's development, well-being, and school readiness for serving over 1 million children every year in 50 states (Bloom & Weiland, 2015; Chor, 2018; Cooper & Lanza, 2014; US Department of Health and Human Services - DHHS, 2010, 2019A, 2020, n.d.A; Hayes et al., 2017; Resnick, 2010; Sabol et al., 2020). As this federal effort grew, the researchers and policymakers sought to examine the quality of services provided and outcomes from children as well improve the quality and effectiveness of Head Start services for children and families. As such, data from Head Start programs provide opportunities to examine quality in early childhood education programs and how characteristics of workforce in programs may be related to Head Start classroom quality.

Quest for Quality

As a result of continued research and theoretical understanding regarding child/human development, the definitions of quality in ECE have evolved over the years, offering new perspectives and suggesting additional program components that are important in quality ECE services. These advancements resonated with ECE settings including Head Start classrooms. As researchers found associations between classroom quality and a multitude of variables, they described these features in categories such as activities, materials, and interactions. One of the most popular categorizations of variables related to classroom quality is the distinction between structural and process/relational quality (Pianta et al., 2016; Vandell, 2004). Structural quality focuses on the physical environment, materials, group size, child/adult ratios in the classroom; and process/relational quality emphasizes the experiences, relationships, and interactions within the settings (Aikens et al., 2016; Peck & Stephen, 2014; McCoy et al., 2015; Pianta et al., 2016). Additional research has suggested that programs with higher structural and process quality are associated with better outcomes for children (Aikens et al., 2016A, 2016B; Clifford et al., 2020). Thus, policy makers, practitioners, and researchers have sought to improve quality of care children receive by evaluating the quality of structural and process quality within programs systematically.

The Aligned Monitoring System within Head Start was established as a quality assurance system to promote high quality services for children. This quality assurance system includes Head Start Program Performance Standards (HSPPS) as well as program monitoring processes that involve document reviews, off-site and on-site interviews, and classroom observations. Program features related to structural quality, such as group sizes and teacher qualifications, are monitored. In 2010 the Office of Head Start (OHS) adopted the Classroom Assessment Scoring

System (CLASS) to assess process quality. CLASS, as a standardized, observational classroom quality measure, includes three domains Emotional Support, Classroom Organization, and Instructional Support to observe teacher-child interactions in the classroom (Pianta et al., 2008).

OHS reviewers conduct CLASS observations in randomly chosen classrooms in each program every five years (DHHS, 2019B, 1304.16). Despite the standardized quality monitoring efforts, researchers point out within (i.e., different classrooms have varied quality scores within the same center) and between (i.e., overall quality differences among neighborhoods, states, etc.) program quality variations in the Head Start system. The random classroom selection approach during CLASS observations is not completely reflective of programs' overall quality because data only reflects the selected classrooms (Sabol et al., 2020). As a result, this variation in the classroom quality suggests the need to further explore potential contextual predictors of quality, such as teacher characteristics professional development opportunities, and work environment in the centers.

Requirements for Teachers and Sustaining Professional Development

Among the above-mentioned predictors, characteristics of the teachers have been an important consideration for ensuring high-quality ECE practice. Head Start regulates minimum requirements for teachers within the nationwide standards. According to HSPPS, fifty percent of Head Start center-based teachers, nationally, are expected to have a Bachelor's degree in child development, ECE, or equivalent coursework, and each program is required to have at least one teacher with a Bachelor's degree in ECE (DHHS, 2007, 648A(a)(3)(B); DHHS, 2016, 1302.91(2)(i)&(ii)). Furthermore, HSPPS require teachers to complete at least 15 hours of professional development (PD) per year, with coaching support determined according to teachers' needs (DHHS, 2016, 1302.92; Sabol et al., 2020). predictors, the teachers have been an

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Teachers' qualifications are not only a policy emphasis but also a research emphasis in the ECE field. Several researchers have explored the associations between the quality of ECE settings and teacher characteristics. These characteristics usually include teachers' educational background such as highest degree and field, years of experience, and in-service professional development activities (Aikens et al., 2016A; Burchinal et al., 2002; Early et al., 2007; Egert et al., 2018; LoCasale-Crouch et al., 2007; Son et al., 2013). However, study findings indicate inconsistent results related to the teacher-related variables and program/classroom quality. For instance, there are studies which did not find significant associations between teachers' level of education and classroom quality (Bulotsky-Shearer et al., 2012; Early et al. 2007; LoCasale-Crouch et al., 2007; Son et al., 2013). On the other hand, a considerable number of studies suggest that teachers' professional experiences (e.g., years of experience, PD) are predictors of classroom quality and better child outcomes (Lorio & Woods, 2020; Raver et al., 2008; Son et al., 2013; Zan & Donegan, 2014). These mixed results lend support to the need for further research regarding teachers' characteristics and other previously unconsidered contextual factors

predicting classroom quality. If factors beyond teachers' characteristics influence quality of care children receive, it is important to understand how these are associated with classroom quality.

Factors Beyond the Classroom

In addition to these teacher- and classroom-level quality factors, developmental theories emphasize the importance of contextuality. Theories such as the bioecological approach to human development (e.g., Bronfenbrenner & Morris, 2007) help policymakers and researchers recognize "beyond the classroom door" features which could be associated with the quality of ECE settings (Clifford et al., 2020; Resnick, 2010). For instance, ECE classrooms and programs are complex environments that reflect processes such as relationships and interactions among a variety of people. These processes occur through inter-relations between people (e.g., teachers, parents, children, program staff), within contexts (e.g., classroom, center, neighborhood, district), which extends over time. From this point of view, several researchers have delved into the quality of care not only as it relates to teachers' qualifications but also considered the work environment (e.g., public vs. private sector differences, perceived respect in the community, teamwork opportunities) as a predictor of teachers' experiences, and in turn, quality of care (Cassidy et al., 2011; Cassidy et al., 2019; Lower & Cassidy, 2007; Madill et al., 2018; National Research Council, 2015; Zinsser & Curby, 2014; Zinsser et al., 2016).

As researchers explored the relationship between teachers' work environment and the quality of care they provide, the program administrator or center director is considered as an additional feature of teachers' context that could be related to the classroom quality. Within the literature on work environment of ECE teachers (including Head Start), center directors have been an area of exploration. Studies have indicated that directors' level of education, professional experiences (e.g., years of experience, PD), and well-being are associated with the center

climate, including classroom quality and teachers' well-being (Cassidy et al., 2011; Harding et al., 2019A, 2019B; Mims et al., 2008; Zinsser & Curby, 2014). However, evidence on directors and administrative processes are neither detailed nor sufficient to draw conclusions regarding the relationships observed.

Need for the Current Study

Despite recognizing the contextual factors, in the relevant literature many indicators of quality remain unmeasured because every study, according to its unique interest, provides a partial snapshot of quality in ECE settings (Clifford et al., 2020). When it comes to teachers' characteristics as predictors of classroom quality, the literature contains mixed results (e.g., Early et al. 2007; Son et al., 2013). Furthermore, as mentioned above, in the ECE literature administrative processes and their relationship to observed classroom quality have not been fully examined.

To explore these contextual factors the present study used the Head Start Family and Child Experiences Survey (FACES) data. FACES is a nationally representative, periodic data resource used to explore and describe Head Start's participants, staff, and classroom quality since 1997. This data collection effort is particularly important in terms of reflecting the ongoing trends within the Head Start, as the largest system in the U.S. providing early learning, health, and family well-being services to low-income children and families. Each period of FACES data collection provides greater understanding of the strengths and areas for improvement in the Head Start system and the potential impact of the program on children's outcomes. Within FACES, the workforce is a highlighted component because teacher characteristics seem to be essential for improving children and families' experiences as well as the quality. Therefore, this study aimed to explore Head Start staff's characteristics and professional experiences as they relate to the

quality of classrooms, using the latest FACES 2014 dataset. The findings from the current study are expected to make contribution to the literature by exploring the role of ECE teacher characteristics and factors within their center context, particularly, director characteristics, with a hierarchical linear modeling (HLM) approach for examining classroom quality within Head Start programs across the country.

CHAPTER II: THEORY

Introduction

Within the ECE settings, there are associations between quality and workforce and to multiple factors including persons' individual characteristics, program/center related elements, system-level regulations (e.g., Head Start policies), and a variety of external factors (e.g., community, neighborhood, policies) (Weigensberg et al., 2012). Therefore, ECE settings are complex contexts considering relationships and other factors that are inner-connected and situated within different contexts (Bronfenbrenner & Morris, 2007; Hayes et al., 2017; Rosa & Tudge, 2013; Weigensberg et al., 2012). For instance, individual classrooms are part of centers, which are part of larger ECE systems. The present study was framed in light of Bronfenbrenner's Bioecological Theory of Human Development considering the unique early childhood context and dynamic interactions among individuals, particularly, teachers and directors in ECE settings. The following chapter describes the components of Bronfenbrenner's bioecological theory of human development, offering examples from ECE research that are applicable for each component. The chapter concludes with a description of how the proposed study applies the bioecological theory as a framework for the research.

Bronfenbrenner's Bioecological Theory of Human Development and PPCT Model

In the bioecological theory of human development, Bronfenbrenner explained development as a combination of continuous, dynamic, progressive, and bidirectional processes occurring between the individual and the context throughout the individual's lifetime. Therefore, they considered interconnected influences beyond the individual to explain human development (Bronfenbrenner & Morris, 2007; Hayes et al., 2017).

As a result, the last version of the theory, is the bioecological theory, has four main components: *process (P), person (P), context (C), and time (T).* Also known as the *PPCT model*, this theory provides an overarching approach to human development. It does not isolate the individual; instead, it considers their nature in an interactive, social, contextual, and holistic way (Bronfenbrenner & Morris, 2007; Hayes et al., 2017; Tudge et al., 2009). In this regard, the PPCT model can be used to examine the complex nature of the ECE settings and explain the individuals' (e.g., children, workforce) developmental processes as a combination of their personal characteristics, ongoing interactions, context, and time. Each component of the PPCT model is explained in the following subsections, highlighting connections to the ECE workforce and quality which are the focus for this study.

Process (P)

The process component, also known as proximal processes, is the core of the PPCT model (Bronfenbrenner & Morris, 2007; Hayes et al., 2017). Proximal processes refer to the forms of complex, progressive interactions between the person (P) and the environment, ideally in stable and continuous settings over time. In the PPCT model, proximal processes are the summation of the rest of the three components (person, context, and time). In other words, processes occur as a combination of personal characteristics, stimulating environments, and on-going and progressive interactions among people over time.

Applying the PPCT model to the present study, PD experience could easily relate to change and development through the proximal processes for ECE teachers. Many scholars define ECE teachers' professional development as activities that aim to support and improve teachers' professional dispositions, knowledge, and skills (La Paro & King, 2019; Winton & Snyder, 2015). In order to facilitate development, teachers need to be involved in various types of

ongoing interactions such as collaborations with colleagues, coaching, mentoring, modeling, feedback, and follow-ups with other colleagues and professionals (Amireh, 2016; Baughan et al., 2019; Darling-Hammond et al., 2017; Dunst, 2015; Siraj et al., 2018; Snyder et al., 2012; Winton & Snyder, 2015). For instance, a recent literature review highlighted the importance of colleagues' joint efforts within the job-embedded settings to practice new techniques and skills in a continuous manner for effective PD experiences; in other words, continuity in processes makes the proximal processes most effective (Siraj et al., 2019). Several studies have emphasized the importance of ongoing PD proximal processes to support ECE teachers and improve the quality of the education and classroom settings (Gomez et al., 2015; Son et al., 2013; Winton & Snyder, 2015).

Person (P)

The person component of the PPCT model refers to the focal, developing individual, and involves three types of characteristics: *demand, resource,* and *dispositions*. Demand features can include the first impressions during interactions, such as gender, race, and age. Resource features include an individual's abilities, skills, knowledge, and experiences. These features function as basis for the potential proximal processes. For instance, in the case of an individual lacking the required resource characteristics (e.g., genetic defects, degenerative processes such as accidents), proximal processes could be limited or disrupted (Bronfenbrenner and Morris, 2007; Rosa &Tudge, 2013). Lastly, disposition (force) characteristics include the person's internal motivation and attention which keep the person focused during the proximal processes (Bronfenbrenner and Morris, 2007; Ejimofor, 2015; Hayes et al., 2017; Tudge et al., 2009).

Researchers tend to study different aspects of ECE workforce *person* characteristics in relation to dynamics of the work environment, quality of the settings, or child outcomes (Early et

al., 2007; Mims et al., 2008; Wells, 2017; Zinsser & Curby, 2014; Zinsser et al., 2016). For instance, Early and colleagues (2007) examined the associations between classroom quality and ECE teachers' educational degrees, or their *resource characteristics*. In this study, researchers did not find significant associations between classroom quality and teachers' degrees. They suggested that the relationship between teachers' education and quality could be influenced by other factors within the teachers' backgrounds, such as the teacher preparation program they attended; contextual factors such as the support available for teachers within the program they are working for could also be considered. In this regard, conflicting labor market forces including variation in wages and degree requirements can be considered among these contextual factors.

Parallel to this point of view, teachers' *disposition characteristics* seem to be related to the work environment and system-level policies. Among disposition characteristics, ECE teachers' well-being, including their depressive symptoms, need for support, and job satisfaction are commonly studied (Cassidy et al., 2019; Madill et al., 2018; Roberts et al., 2016; Zinsser et al., 2016). Research indicates that poor teacher well-being is associated with lower quality in ECE practice. Further, these disposition characteristics seem to be associated with context-related factors such as low wages, high turn-over rates, and lack of PD support (Lower & Cassidy, 2007; Zinsser & Curby, 2014; Zinsser et al., 2016). From this point of view, while studying ECE teachers' *person* characteristics, it is difficult to draw conclusions depending solely on person characteristics; instead, it is crucial to consider various context- and person-related variables together for more accurate conclusions. As a result, person characteristics should be considered as fundamental catalyzers of the proximal processes according to the PPCT model.

Context (C)

The context component of the PPCT model refers to the context that surrounds the individual. Bronfenbrenner defined the context as a combination of multi-layered and interrelated systems consisting of microsystem, mesosystem, exosystem, and macrosystem (Bronfenbrenner and Morris, 2007; Ejimofor, 2015; Hayes et al., 2017; Tudge et al., 2009).

Among these systems, *microsystem*s include aspects of the environment impacting the individual's daily life, such as family, school, and work. People spend most of their time in multiple microsystems, and these microsystems are interconnected. *Mesosystem*s refer to these interconnected microsystem contexts; in this regard, the mesosytem does not represent a different layer of context. Instead, it refers to interplay of different microsystems which surround the individual (Bronfenbrenner & Morris, 2007; Tudge et al., 2009). ECE teachers spend most of their workday in the classroom, but there could be occasions such as personnel meetings in the center or PD experiences at a professional conference; each of these contexts refer to different microsystems, but they are interconnected at the same time. Thus, teachers' experiences within these contexts outside the classroom could transfer to the teachers' classroom practice as result of the processes in the other microsystems. The *exosystem* is defined as the context that indirectly impacts the developing person, despite that person's lack of presence within the context (Bronfenbrenner and Morris, 2007; Rosa & Tudge, 2013; Tudge et al., 2009). For instance, when we consider the microsystem of an ECE teacher as their work environment, their colleagues' professional experiences and trainings which take place in different contexts could indirectly impact the developing teacher's practice during interactions such as peer-mentoring. Lastly, the *macrosystem* refers to the social structure and belief systems of larger groups, and it consists of the cultural and political environment surrounding the developing individual. Any

federal-level policy changes in the macro ECE systems influence the other system layers. Within the scope of this study, the federal Head Start system is considered as the macrosystem which shapes the interplay between rules and regulations and workforce dynamics. For instance, when the Head Start School Readiness Act of 2007 required at least 50% of all Head Start teachers have a baccalaureate or higher degree (DHHS, 2007); the HSPPS and the Monitoring System were updated accordingly. Changes in the teacher education requirements and the monitoring systems impacted teachers' microsystems and mesosystems, as many were required to enroll in degree programs.

Time (T)

The time component of the PPCT model refers to the course of time across which the individual experiences proximal processes. Similar to the context component, Bronfenbrenner defined the time with a layered approach (Bronfenbrenner and Morris, 2007; Ejimofor, 2015; Hayes et al., 2017; Tudge et al., 2009). *Micro-time* refers to the specific time when the activity occurs; *meso-time* refers to the ongoing proximal processes and development; and finally, *macro-time* is used to define the timings of events with broader impacts in the system, society, region, or world.

In light of the *time* component, ECE teachers' experiences and proximal processes could be explained by their classroom activities, both with the specific events and ongoing academic years in the *micro-* and *meso-time* frames. Bronfenbrenner emphasized the importance of regularity and consistency for ensuring effective proximal processes, in contrast to the unstable, inconsistent, and unpredictable processes. Relatedly, experimental PD studies in the literature are good examples to highlight the value of time for explaining ECE teachers' proximal processes. Intervention-based PD studies are planned within a certain time period (e.g., duration and

intensity) and aim to support teachers' knowledge, skills, or dispositions, depending on the intervention's intention (Siraj et al., 2018). For instance, Powell and colleagues (2010) conducted a randomized control trial comparison with Head Start teachers using an intervention on early literacy instruction in ECE settings. This study took two years to complete the PD intervention, and its results revealed positive effects on the teachers' practice, classroom environment, and child outcomes. Additional research has investigated the time component of PD studies, exploring the ideal duration and intensity of PD. In Egert and colleagues' (2018) meta-analysis from 36 studies, longer durations of higher intensity PD interventions were not associated with greater effects on teachers' practice. However, split durations with breaks and a medium intensity around 45 to 60 hours were associated with positive PD outcomes. Another study referred to at least 20 hours distributed over 15-20 weeks as the most effective in-service PD dosage for desired outcomes (Dunst, 2015). These results are also parallel to Bronfenbrenner's ideas asserting that extremes approach to time, either in the form of disorganization or rigidity, could prevent potential growth (Bronfenbrenner & Morris, 2007). Therefore, although the "ideal amount of time" for PD interventions is open to debate, time is an essential component for ensuring changes in teachers' skills and practice.

Further, systematic changes in education systems could directly impact teachers' work-life at the *macro-time level*. Policies and research on the quality of ECE settings have evolved over the previous decades. Until the 1990s, the earlier efforts of quality measurement and improvement in ECE settings were limited to aspects of the classroom (Clifford et al., 2020). However, as the emphasis on the contextual factors in human development increased based on contemporary theories (e.g., Bronfenbrenner, Vygotsky), policymakers acknowledged the importance of the context and workforce on the quality of ECE. Thus, Quality Rating and

Improvement Systems (QRISs) started to regulate workforce requirements and professional development as a part of the accreditation process of ECE settings (Clifford, et al., 2020). Around the same period, the Head Start Act enforced new regulations to increase workforce qualifications (DHHS, 2007). Relatedly, researchers have conducted studies to see the impacts of these changing policies. For instance, Harding and colleagues (2019A) analyzed six cohorts of FACES datasets starting from 1997 to 2014 to examine the changes in Head Start teachers' well-being, developmentally appropriate attitudes, and teaching practices in relation to the PD support they received over time. In contrast to hypotheses, teachers' responses from different cohorts were not significantly different. Even though this study did not indicate the expected results of policy shifts during the given time period, the researchers emphasized the importance of macro-time effects on ECE workforce and pointed out the need for more in-depth data regarding PD activities' quality, content, and frequency. Therefore, from a macro perspective, the policymakers and researchers' approach to the quality of ECE settings has changed as they take the contexts into consideration and embrace the importance of workforce over the years.

Applying Bronfenbrenner's Theory to the Current Study

Bronfenbrenner's Bioecological Theory framed the present study. The Head Start teacher, as the focal developing person, was examined with a particular interest in their resource characteristics, including educational background and years of experience as the potential predictors of the classroom quality.

The context component in the study explored the Head Start teachers' work context consisting of their *microsystems, mesosystems, exosystems, and macrosystems.* Although teachers spend most of the day in their classroom as their microsystem, their work-related context is not limited with classroom. They experience multiple microsystems within the center.

According to the current study's framework, as a result of their positionality within the center, center directors take place in teachers' microsystem, mesosystem, and exosystem simultaneously. They are responsible for all the classrooms and teachers in centers, so the teachers build inevitable direct interactions with the directors in their micro and mesosytems during daily routine. Further, directors form an exosystem context for teachers with bringing their background and experiences indirectly involved during the interactions. They bring their professional background to these interactions, as they continue building new experiences such as professional development, expanding workload, and relationships with changing human resources and families. Lastly, since the FACES provides nationally representative data, the study also reflects Head Start as the teachers' macrosystem.

In terms of the *proximal processes,* teachers' self-reports regarding their ongoing PD experiences were examined to indicate whether these experiences predict the classroom quality. Moreover, director characteristics were also tested as the moderatos of the teachers' proximal processes to predict the classroom quality performance. The *time* component of Bronfenbrenner's PPCT model was not included, as longitudinal data are not available in the dataset.

To conclude, the complex nature of educational contexts involves many different interactions among individuals. Thus, the PPCT model can be used to explain the complexities in these contexts. In the present study, particularly, the interplay of proximal processes (e.g., PD) and resource characteristics of the ECE teachers were explored within the Head Start context. Therefore, Bronfenbrenner's Bioecological Theory helped to highlight Head Start's multi-layered structure (i.e., classrooms and workforce within centers), as well as to explore the interrelated workforce dynamics in relation to the classroom quality.

CHAPTER III: LITERATURE REVIEW

Introduction

Ensuring high-quality ECE settings requires an understanding of the components which are related to quality. Initially, this literature review aims to provide the foundations about the quality in ECE settings, including its conceptual definitions and measurement tools in practice. Since the present study aimed to explore the classroom quality of the Head Start centers according to the teacher and director characteristics, the following sections explain the Head Start context and policies in terms of the quality monitoring system and workforce requirements. In light of these conceptual, practical, and policy foundations, the remaining sections of the literature review aim to share and discuss the previous studies' results related to the scope of this study. Therefore, the relevant literature is organized according to the studies that emphasized teacher characteristics, and the work environment, particularly center director characteristics, and associations with classroom quality.

Frameworks for Understanding Quality of ECE Settings

ECE quality has been discussed and been the subject of research around the world with an evolving approach to its definitions, components, and assessment in the last decades. The initial ECE studies did not disentangle the quality, type, or amount of the service clearly (Vandell, 2004). Over the years, as the inquiries continued, researchers used more advanced methodologies and found associations between classroom quality and several variables, including the supportive interactions, children's developmental competencies, and school readiness (Vandell & Wolfe, 2000; Vandell, 2004; Zinsser et al., 2016). These results highlighted the importance of processes within the settings. Following these findings researchers started to

unpack the complexity and multiple dimensions of ECE settings that could influence these vital processes (Vandell, 2004). One of the commonly referred categorization for quality of ECE settings appeared as *structural* and *process/relational* quality. In this regard, structural quality refers to the physical environment and quantifiable indicators such as materials, child/adult ratios, providers' educational background in the classroom. Process/relational quality, on the other hand, includes the experiences, relationships, and interactions among teachers and children (Aikens et al., 2016A&B; Cassidy et al., 2005; Peck & Stephen, 2014; McCoy et al., 2015; Perlman et al., 2016; Pianta et al., 2016; Vandell & Wolfe, 2000; Vandell, 2004).

It is also important to note that the quality of ECE settings is not limited to the classroom context (e.g., teachers-child interactions, materials), but also includes each stakeholder's perceptions (e.g., children, families, workforce), geography, and political structure; therefore, some scholars assert that quality is not completely objective (Katz, 1993; Moss & Dahlberg, 2008). In this regard, Resnick (2010) emphasized the "beyond the classroom door" features such as management styles, resources, and demographics of the surrounding community as the variables which could impact the quality of an ECE setting. Thus, the center directors in ECE settings can be considered as an important variable in terms of quality.

Parallel to Resnick's approach, another conceptual framework for quality in ECE settings by Katz (1993) also asserted the value of stakeholders' perspectives. They categorized the quality of ECE settings according to five perspectives: top-down, bottom-up, outside-inside, inside, and outside. Each of these perspectives referred to a different angle and aspect of ECE. The *top-down perspective* focuses on the structural characteristics such as the ratio of adults to children, qualifications and stability of the staff, aspects of staff working conditions, ensuring health and hygiene of the ECE settings, and the like. *The bottom-up perspective* puts the child's feelings and

opinions to the center and considers whether they feel welcomed, accepted, and protected. The *outside-inside perspective* takes the family-teacher relationships into account and focuses on parents' opinions about teachers, including being respectful, inclusive, and providing ongoing communication. The *inside perspective* is about the staff's perceptions within a program regarding the relationships with colleagues, parents, and administrative agency. Lastly, the *outside perspective* considers the community's experiences; therefore, this perspective expects support from public or private agencies, policymakers, and rules and regulations in the governing-level, providing ECE programs with resources to support adequate, affordable, and protective services with qualified staff (Katz, 1993). Resnick's considerations regarding the factors beyond the classroom, as well as Katz's quality framework - in particular, from the top-down and inside perspectives are used to support the current study's focus on teacher and center director characteristics and their relations to the classroom quality.

Measurement of Quality in ECE Settings

These quality frameworks help to zoom-in on quality components, but they are not equivalent to defined thresholds/criteria regarding the quality of an ECE setting. This distinction brings the question: how can we objectively decide whether an ECE classroom is high-quality? Answering this question is particularly important in order to promote standardized systems at the policy-level and for increased validity in research projects. Not surprisingly, evolving quality frameworks along with the indicated associations between quality of ECE classrooms and child outcomes, shed light on the needs for understanding and improving the settings. In this regard, the structural quality was relatively easy to measure by defining certain thresholds such as class size, adult/child ratio, spacing, and quantity of materials (Cassidy et al., 2005). However, process quality was challenging to measure because it needs more in-depth indicators and observations

(Perlman et al., 2016). As described in the section below, the field's approach to measuring quality has evolved, moving from a focus on structural quality to a growing emphasis on process quality.

Starting from the 1970s, in the United States, researchers put efforts into defining the quality indicators in ECE settings and measured them with developing environment rating scales (ERSs) (Cassidy et al., 2005; Clifford et al., 2020). These scales aim to measure structure and process quality in the classrooms with a target of age groups such as infant/toddler (Infant-Toddler Environment Rating Scale - ITERS), 3-5 years (Early Childhood Environments Rating Scale - ECERS), and school-age (5-12) (School-Age Care Environment Rating Scale - SACERS). Additionally, the Family Child Care Environment Rating Scale (FCCERS) is used in provider homes for the ages between infancy to school age. Recently, after initial and revised editions, the 3rd editions of each scale were published (Harms et al., 2013, 2014, 2017, 2019). The quality in these measures refer to three main components: protecting children's health and safety, building positive relationships in the classroom environment, and opportunities for stimulation and learning from experience (FPG, n.d.). Thus, each scale includes similar subscales, such as space and furnishing, personal care routines, language and books, activities, interaction, program structure (FPG, n.d.; Harms et al., 2013, 2014, 2017, 2019). Among these scales, in particular, the ECERS-Revised edition became quite popular in research and was used internationally in several studies in the literature (FPG, n.d.; Sylva et al., 2006; Vermeer et al., 2016).

To extend the focus on process quality, Pianta and colleagues (2008) developed the Classroom Assessment Scoring System (CLASS) for measuring classroom centered on teacher-child interactions in three domains, Emotional Support, Classroom Organization, and

Instructional Support (Pianta et al., 2008). The *Classroom Organization* domain measures teachers' skills for minimizing the behavior problems and maximizing children's attention by structuring the classroom appropriately. The *Emotional Support* highlights teachers' skills for creating secure, warm, and responsive interactions with children. Lastly, the *Instructional Support* focuses on how teachers facilitate learning in the classroom (Perlman et al., 2016; Pianta et al., 2008). CLASS has been a widely used measure not only in research studies but also in practice and policy (e.g., quality assurance systems, Head Start Aligned Monitoring System). Further, it has been an important index in professional development activities for improving teachers' instructional practices (Perlman et al., 2016). Thus, CLASS, as a relatively new measure, has a stronger focus on the process quality compared to the ERSs (Perlman et al., 2016) and is the focus of the current study as it relates to the process quality of Head Start classrooms.

Therefore, ERSs and CLASS have been fundamental for measuring the classroom quality within the ECE systems for both research and policy purposes. However, these scales mainly measure the microsystem aspects of ECE settings. In order to expand the understanding of contextual considerations, and provide a broader examination of factors associated with classroom quality, more in-depth inquiries are needed in the field (Clifford et al., 2020).

These improvements in the quality measurement tools for ECE settings go hand-in-hand with the policies. In the United States, starting from the late 1990s, policymakers began integrating QRIS*s* as accreditation systems for the ECE settings at the state-level. This system aimed to "assess, improve, and communicate the level of quality" within the ECE programs (QRIS Guide, n.d.). QRIS incentivizes the conditions for higher quality ECE services with the increased professional development of ECE providers and increased parent consciousness about demanding higher quality services for their children. According to the 2017 QRIS Fact Sheet, 44

states regulate the ECE system with QRISs. These regulations involve ERSs and CLASS as official quality measurement tools within the QRISs and Head Start programs (QRIS Guide, n.d.). Thus, the use of these tools to monitor programs became an important feature for improving the quality of care.

Head Start Context

Head Start is a significant program within the ECE system in the United States. It is the largest publicly funded preschool program for children from low-income families and has its own quality monitoring system. Since it is the focus of the present study, the next subsections aim to explain the context and quality assurance system of Head Start.

Head Start was established in 1965, after President Lyndon B. Johnson's declaration for the "war on poverty," as an initiative to support children who faced poverty (Bloom & Weiland, 2015; Chor, 2018; Cooper & Lanza, 2014; DHHS, 2010; Hayes et al., 2017; Resnick, 2010; Sabol et al., 2020). Currently, this federally funded program is administered by the Office of Head Start under the umbrella of Administration for Children and Families (ACF) of the U.S. Department of Health and Human Services (DHHS) (Bloom & Weiland, 2015).

After its inception in 1965, there were two congressional reauthorizations of the Head Start. The first one was authorized in 1998 (Community Opportunities, Accountability, and Training and Educational Services Act) and the other one was in 2007 (Improving Head Start for School Readiness Act), which is also called the "Head Start Act" (DHHS, 2007; DHHS, 2010; Powell et al., 2010). These acts emphasized children's school readiness, in particular, literacy and language skills of children and improving their success in kindergarten and primary school (Powell et al., 2010). In the Act of 1998, for instance, after over 30 years of Head Start, Congress mandated national-level research to inquire about the most effective circumstances of this

programs and the impact on children's developmental and learning outcomes Thus, DHHS was assigned to conduct this nationwide Head Start Impact Study (HSIS) (Connors et al., 2014; DHHS, 2010). Today, the updated rules and regulations in the Head Start Act of 2007, as well as Head Start Program Performance Standards, are still valid and in use (DHHS, 2007, 2016).

The Head Start program adopts the "whole child" model and support children's growth and development through health, nutrition, educational opportunities, and social services for children and their families (Bloom & Weiland, 2015; Cooper & Lanza, 2014; DHHS, 2010). Depending on the families' and children's needs, these services are provided in center-based, home-based, and family childcare homes (DHHS, 2010; DHHS, n.d.A). With the help of a wide range of services, Head Start supports not only school readiness but also participants' well-being and health.

Head Start provides early learning experiences, mostly in centers for families and their children whose income is within the range of national poverty guidelines (Resnick, 2010). Over the past 50 years, the Head Start program has supported about one million children around a cost of seven to nine billion dollars per year (Bloom & Weiland, 2015; Chor, 2018; DHHS, 2016; Sabol et al., 2020).

Head Start Quality Monitoring System

While providing the services mentioned above, the Office of Head Start needs to ensure its effectiveness and quality with sets of rules and regulations with a quality monitoring system. This monitoring system is called Aligned Monitoring System (AMS) and is regulated according to the Head Start Act, Head Start Program Performance Standards (HSPPS), and related state policies (e.g., QRIS). Within the Head Start system, programs are expected to compete for funding in Designation Renewal System (DRS) every five years (DHHS, 2019A & 2019B).

AMS regulates the competition protocols by collecting data from the programs through document reviews, interviews, and classroom observations.

OHS has been conducting formal assessments using the CLASS measure since 2010 to analyze and assess the effectiveness of interaction between teachers and children in the classrooms. CLASS observations are conducted in randomly chosen classrooms in each program by OHS CLASS reviewers (DHHS, 2019B; DHHS, 2016, 1304.16). The quality thresholds for CLASS are categorized into two: the *quality thresholds* and *competitive thresholds*. Quality thresholds are set at six points for the Emotional Support and Classroom Organization domains and three for the Instructional Support domain. On the other hand, *competitive* thresholds are lower than the *quality* ones: five points for the Emotional Support and Classroom Organization domains, and 2.5 points for the Instructional Support domain. If programs score lower than the given competitive thresholds, they are required to compete for grant within the DRS (ECLKC, n.d.). If a program achieves above these thresholds, they ensure their grant until the next assessment period.

As the program data come from these AMS processes, they are pooled in the AMS 2.0 online system. Each programs' data should be in AMS 2.0 by the 4th year for every grantee before the five-year grant cycle ends. This data is used in the DRS in order to approve the next five-year grant cycle to the grantees (DHHS, 2019B).

According to the Head Start Act (Sec.641) and HSPSS (1301, 1302, and 1303), a grantee must meet the designation renewal criteria and steps. Furthermore, in case of a defined deficiency in Head Start Act (sec. 637(2)(c)), the grantee is responsible for correcting this deficiency according to Sec.641A(e)(1)(B) of the Act, unless the HHS official does not require to correct it immediately. Still, the grantee is responsible for submitting a Quality Improvement

Plan and point out this deficiency and the resolution plan. According to this data, programs could revise and change their program improvement plans as needed (DHHS, 2007, Sec. 641A.; DHHS, 2016, 1302.102). Therefore, this system requires center/grantee directors to follow and record center data regularly.

ECE Workforce Requirements and Professional Development

Throughout efforts to promote high quality in the ECE settings, the ECE workforce has been fundamental as the service providers are the persons who actually work with the children. Thus, the workforce's qualifications and professional development (PD) needed focused attention to support children and families effectively (Harding et al., 2019B). The requirements for teacher employment have been regulated within ECE systems, including both the teaching workforce's educational background and professional development (PD) needed to support children and families effectively (Harding et al., 2019). For instance, in the US, in 2002 65% of the statefunded ECE programs required at least 15 hours of PD per year, and by 2016 this increased to 85%. Similarly, Head Start regulated teachers' PD activities in 2007 Head Start Act and required 15 PD hours annually (Barnett et al., 2017; also cited by Harding et al., 2019B; DHHS, 2020).

The ECE literature defines PD according to two phases: pre-service and in-service. Pre-service PD refers to activities completed before entering the workforce, and in-service PD occurs after entering workforce. Receiving a degree or credentials is usually perceived as pre-service PD activities. However, the ECE workforce often does not fit this distinction because of inconsistent hiring requirements. Many teachers enter the ECE workforce without a degree, higher education/certification trainings could still occur similar to an in-service PD activity while

they teach in the classrooms (Gomez et al., 2015; National Research Council, 2015; Snyder et al., 2012).

Within this framework, higher education includes associate, bachelor, and graduate degrees. If these are ECE related degrees, they provide training on theory and practice with hands-on opportunities in the ECE classrooms. However, higher education curricula could depend on the nationwide and statewide teaching standards (e.g., NAEYC), the department (e.g., school of education, child development, human development, and family studies), and faculty members' major interests. Higher education usually takes between two to four years. The varying higher education system is a critical point in terms of lacking alignment among the diploma and licensing qualifications in the ECE field (Gomez et al., 2014; National Research Council, 2015; Snyder et al., 2012).

There are also competency-based credentials, and these credentials are usually established through state or national-level regulations. This pathway also works as both a pre- and an in-service step toward higher qualifications in order to earn an accredited licensure to work as an ECE teacher. In the last decade, state-level QRISs require these licensures for people who are seeking to be teachers. For instance, a state may have developed a state-level credentialing system. In addition, the Child Development Associate (CDA) is the most common, nationally accepted credential system for ECE teachers (Gomez et al., 2015; National Research Council, 2015; Snyder et al., 2012). To receive CDA credentials, teachers must complete 120 hours of training on health, development, care and education of young children; they must renew these credentials every three years (Gomez et al., 2015).

Acknowledging a degree/diploma is easier and quantifiable; in contrast, in-service (i.e., ongoing, experience-based) professional development is not as clearly defined in the literature.

Therefore, in-service PD activities are often defined and implemented uniquely in each study setting and this uniqueness leads to a lack of specificity in the literature (Schachter, 2015). A clear example of the definition of in-service PD for the ECE workforce was provided by NAEYC (2011), which defined PD as "a continuum of learning and support activities designed to prepare individuals for work with and on behalf of young children and their families, as well as ongoing experiences to enhance this work" (p.5). Another recent study defined PD as a structured professional learning opportunity which changes teacher's practice and improves the student learning outcomes (Darling-Hammond et al., 2017).

Beyond the work to develop overarching definitions of PD, as a result of conducting studies in different contexts, several scholars in the field have attempted to define the key features, in other words, "active ingredients" of effective PD for ECE teachers (Darling-Hammond et al., 2017; Dunst, 2015; Egert et al., 2018; La Paro & King, 2019; NAEYC, 2011; Snyder et al., 2012; Winton & Snyder, 2015). These key features are usually categorized under three components for PD: "who?" "what?" and "how?" and researchers assert that answering these three questions provides a great deal of information when designing an effective PD program. *Who* refers to the target learner and the facilitator of a PD training; *what* refers to the content of a PD training; finally, the *how* component of PD in ECE covers multiple essential considerations, including delivery strategies, intensity, and duration of the training (La Paro & King, 2019; Winton & Snyder, 2015). However, there is neither one correct form nor a unified routine for this component because the needs and backgrounds of the workforce vary according to circumstances (e.g., region, educational background, children’s abilities and background in the classroom) (La Paro & King, 2019; Winton & Snyder, 2015). Within the current study, each component is defined by variables included within the dataset. *Who* refers to teachers and

directors. From the theoretical perspective of the study, the developing individual was defined as teacher, and the directors were considered as the potential facilitators of teachers' in-service professional development processes (i.e., proximal processes) within the center context. For sure, there are several potential facilitators who contribute to the teachers' development, including colleagues, peers, and mentors/coaches; however, this study limited this component to the center directors as direct and indirect facilitators. When it comes to *what* component, the PD activities were categorized into two topics as curriculum and assessment trainings. Lastly, this study approached the how portion as the intensity of these PD experiences, and mentoring, and T/TA as delivery strategies.

Studies indicate that effective PD includes elements such as using a combination of strategies such as collaboration with other colleagues and professionals, ongoing coaching/mentoring support (including modeling), time for reflection, opportunities to practice new skills, periodical evaluation including follow-ups, and feedback (Amireh, 2016; Baughan et al., 2019; Darling-Hammond et al., 2017; Dunst, 2015; Siraj et al., 2018; Snyder et al., 2012; Winton & Snyder, 2015). More recently, with the help of advanced technologies, PD activities are moving to online platforms. However, studies show that these online opportunities work better when they pair with face-to-face activities (Siraj et al., 2018).

In light of the evolving literature and regulations across the US, as mentioned above, PD requirements for ECE workforce have changed gradually. As mentioned above, 85% of the state-funded pre-K programs required at least 15 hours of PD per year in 2016, which was 65% in 2002 (Barnett et al., 2017; also cited by Harding et al., 2019A). Besides federal efforts, state legislators initiated statewide regulations for improving ECE services, and QRISs started to spread throughout the country for improving and sustaining ECE quality. These policy and

practice initiatives set up rules and regulations for the ECE workforce qualifications, including specific degree requirements and ongoing professional development. Expectedly, Head Start regulates the workforce's professional requirements for reaching better quality services. The Head Start requirements are described below.

Requirements for Teachers in Head Start

Minimum requirements for teachers are defined in Head Start Act and HSPPS. For HS center-based teachers, no less than fifty percent of all Head Start teachers, nationwide, must have a baccalaureate degree in child development, early childhood education, or equivalent coursework. These requirements also state that each program must hire at least one teacher with these degrees (Head Start Act, 648A(a)(3)(B); DHHS, 2016, 1302.91(2)(i)&(ii)), meaning that in each classroom teacher qualifications may vary. In terms of training and professional development, HS Program Performance Standards require at least 15 hours of PD per year and participation in research-based and coordinated coaching support according to the staff's needs (DHHS, 2016, 1302.92; Sabol et al., 2020). The technical assistance and training could include support in literacy development, work with dual language learners, homeless children, and children with disabilities, family involvement, improving children's health and well-being, working in rural communities, and the like (DHHS, 2016, 1302.92). The standard 1302.92 also specifies that the PD activities should be research-based and align with the Head Start Early Learning Outcomes Framework, but do not require a specific approach. In case of a need for further PD support, program directors must seek external help and collaborations from other field experts (DHHS, 2016, 1302.92; Harding et al., 2019B). Some of the examples of available PD activities include coaching support, 1-day trainings, and short-term workshops (Head Start Act, Harding et al., 2019B).

Requirements for Center Directors in Head Start

According to HSPPS (DHHS, 2016, 1302.91 & 1302.92), Head Start directors are required to have a minimum baccalaureate degree and experience in supervision of staff, fiscal management, and administration. However, these standards do not make a distinction about program and center directors. Thus, they do not provide detailed requirements regarding center directors.

To sum up, in Head Start, the standards of quality services go hand in hand with the qualifications of ECE teachers, but not for the center directors. What does literature say about this? Parallel to PPCT model's context component, researchers tend to predict the quality of ECE settings according to the contextual factors such as workforce and center climate. To further describe the focus of the current study is to explore the classroom quality in relation to the teacher and center director characteristics, the literature review is organized according to these main components in the next sections.

Major Studies on Quality in Head Start

Head Start, as the largest federal ECE system, not surprisingly, has been a research focus for many scholars. The ongoing practice, quality, and outcomes of Head Start have been studied in both nationwide research projects and smaller-scale studies. However, the mixed results in the literature have produced debates about the effectiveness and quality of Head Start.

Upon the 1998 Head Start congressional mandate, U.S. DHHS conducted Head Start Impact Study (HSIS) as the first nationwide research effort for exploring Head Start outcomes (DHHS, 2010). This study aimed to determine the impacts of Head Start on children and families who receive Head Start services. HSIS conducted data collection between fall 2002 to 2006 with a group of nationally representative, randomly selected 4667 children using a multi-stage

sampling method. The sample involved children starting from the age of entry to Head Start (3- and 4-year-olds) through the spring semester of 1st grade and continued with a 3rd-grade follow-up study. This study evaluated the children's cognitive, social-emotional, and health outcomes with experimental design for HS and non-HS participants. The key findings indicated that the impacts of HS remained by the time children reached elementary school in terms of their school readiness, social-emotional development, and health domains. However, by the time children reached 3rd grade, there was more of a fade-out in the outcomes (DHHS, 2010; Puma et al., 2012). This large national study led to further research to explore the quality of Head Start and the reasons for this fade-out.

The Family Child Experiences Survey (FACES) study is another nationwide data collection effort for the Head Start. FACES datasets have provided a great deal of information about the program over time. Since 1997, FACES has collected periodical cohort data, reflecting changing demographics and trends among HS programs and children and informing legislative updates for the program (Klein et al., 2018). In each period, FACES use several data collection tools such as children's developmental assessments, parent surveys, teacher surveys, and classroom observations (i.e., ECERS-R and CLASS). Thus, this comprehensive data from the FACES study gives the opportunity for researchers to conduct detailed secondary data analyses as well as make policy connections with their research. The Office of Planning, Research, and Evaluation (OPRE) also conducts periodical analyses on FACES data and publishes federal reports on various topics regarding Head Start such as quality of care, professional development, dual language learners and the like (DHHS, n.d.B).

In a recent OPRE report, Aikens and colleagues (2016A, 2016B) analyzed the data starting from FACES 2006 to 2014 to reflect the quality trends in Head Start. Since FACES use

ECERS-R (short version) and CLASS during their classroom observations, these trends provide results from both measures. In terms of classroom quality, ECERS-R Provisions for Learning and Teaching, as well as the Interactions factors, notably improved throughout the 2006-2014 window. This report indicated that the percentage of teachers with bachelor's or higher degrees increased throughout the data collection period; however, this increase did not explain a significant difference in the observed classroom quality by ECERS-R. Further, when it comes to the CLASS observations, 12% of the increase in CLASS Instructional Support scores were explained as a result of teachers having at least bachelor's degrees. As a result, the improvement in Head Start teachers' degrees did not explain the changes in classrooms' process quality significantly.

Aside from teachers' educational background, the OPRE report also discussed ongoing mentoring support in relation to the classroom quality. Although the mentoring prevalence and frequency were stable from 2006 to 2014, with about three-quarters of teachers having this support, the providers of the mentoring support changed from directors to educational coordinators or specialists throughout the years. However, this change in the given time period was not associated with a significant difference in classroom quality. The authors recommended further research to study the details of the mentoring (e.g., quality, intensity, and intentions) to have a better idea about the associations between mentoring and classroom quality (Aikens et al., 2016A). Also, results indicated that teachers experienced a decrease in the amount of support and feedback with the changes in the PD providers (recently, more support from the mentor teachers and other teachers in the same program) regarding curriculum implementation. In addition to mentoring and coaching, another change was an increase in the amount of in-service training teachers received. Training for teachers evolved from being short, one-day experiences to more

extended periods. Finally, teachers' turnover, job satisfaction, and perceptions about their experiences remained the same. The OPRE report is important in terms of providing nationwide data on progressive trends in observed classroom quality and workforce qualifications of Head Start. However, it also shows that there is still more data needed regarding the mentoring and coaching quality of the system.

Another important consideration for Head Start is the consistency of classroom quality across the system. As mentioned before, the HSPPS and the monitoring system measures the quality in randomly chosen classrooms from a program and reports the findings as the program-level quality. In addition, required teacher qualifications are not applicable to every teacher in the system. These two important points are discussed in a in a recent study by Sabol and colleagues (2020). They hypothesized that program-level quality scores are not reflective for all the classrooms in a program and the mixed results in the existing literature could be related to this monitoring system. They tested their hypothesis with analyzing the FACES 2006 and 2009 data to see the cross-classroom variation of center quality. To test this variation, they divided the FACES samples into two groups (Classroom sample 1 & 2) and each group included a classroom from the same center. Thus, they attempted to see whether the quality was consistent in these two groups. Their simulation indicated if one of the group’s classrooms were picked for a formal evaluation, about 37% of the centers would have resulted in different decisions. In other words, this particular study's results indicated that one third to one half of the variation in classroom structural and process quality occurred between the classrooms within the same center. As mentioned in the previous sections, DRS requires the Head Start agencies to recompete for funding if there are any deficiencies observed across the program (e.g., scoring 2 or below in CLASS instructional support items among the randomly selected classrooms).

Besides this within-program variation quality in Head Start, there is also an essential consideration for the between-variation according to the locations/neighborhoods. McCoy and colleagues (2015) highlighted these neighborhood differences between children's development and classroom quality. They used the HSIS data and combined the items of ECERS and Arnett Caregiver Interaction Scale-CIS with an exploratory and confirmatory factor analysis. Their mediation analysis using these items within HSIS data indicated classroom materials and space related items mediated the association between neighborhood and children's approaches to learning significantly (measured by a tool in FACES). Furthermore, negative teacher-child interactions mediated the associations between neighborhood and children's behavior problems. However, as the neighborhood poverty got higher, classroom quality did not mediate the children's literacy and math outcomes. Unexpectedly, lower structural quality classrooms were associated with better approach to learning child outcomes. The authors speculated that as the teachers have fewer resources in their classrooms, they get more creative and less dependent on the existing curriculum and materials compared to the teachers in classrooms with more resources. However, McCoy et al. (2015) also provided an argument, with the support of literature, about the variation of Head Start teachers' salaries depending on the neighborhoods (i.e., the poorer the neighborhood, the lower the salaries). They continued the argument and emphasized how highly qualified teachers avoid working in these disadvantaged neighborhoods and in turn, classroom quality is lower. Although, the current study does not include the neighborhood amongst the study variables due to the data limitation in FACES, studies discussed above led to speculations and controversy regarding the role of teachers' characteristics and experiences on the quality of settings. Thus, the literature on the quality of Head Start easily yields to the connections with workforce characteristics. In the next subsections, the literature

which presents connections between ECE workforce and quality is discussed; Head Start highlights are provided according to studies' samples.

Studies on Teacher Characteristics and ECE Quality

In the ECE field, the association between teacher characteristics and quality of settings has been part of extensive discussions over years. Studies have captured teachers' professional and personal experiences from different angles, including their demographics, qualifications, and well-being. In this regard, teachers' professional experiences usually cover their PD, such as educational background, years of experience, and ongoing in-service PD efforts (Son et al., 2013). Teachers' degrees, certifications, and participation in ongoing PD are examples for commonly used predictors about the quality of care. Within the theoretical framework of this study, teacher is the focal developing individual and focuses on their resource characteristics shaping their classroom quality performance. Thus, the next section discusses the literature on these characteristics including education, years of experience, and PD experiences, in relation to the classroom quality.

Teachers' Education and ECE Quality

In the literature, teacher education usually refers to the teachers' highest education degree, the field of this degree, and/or certifications in ECE. In contrast to the state-level ECE contexts, within Head Start scope, teachers' education requirements are federally regulated. These regulations allow for teachers to have diverse educational backgrounds. The HSPPS require 50% of the teachers nationwide to have at least bachelor's degree, and at least one teacher with a bachelor's degree per center (ACF, 2016). This regulation, therefore, contributes to varying educational backgrounds within Head Start teachers because once the minimum criterion is met, other teachers in the program can have differing educational credentials.

Expectedly, these different teacher characteristics are evident in research results described below.

In terms of the associations between teacher background and classroom quality, research conducted in ECE settings, including Head Start, indicates mixed results. For instance, one of the widely cited studies conducted by Early and colleagues (2007) analyzed data from seven different large-scale ECE studies, including the FACES 2003 cohort data. This study's results did not indicate significant associations between teacher education (level and major) and classroom quality. Parallel to this study, Bulotsky-Shearer and colleagues (2012) analyzed 1997 FACES data for a multilevel latent profile analysis to see the national profiles of classroom quality and school readiness. Their results did not indicate any significant differences in the classroom profiles according to the teachers' level of education, work experience, or the number of professional trainings each teacher had completed. The profile differences were mainly related to classroom and center characteristics (e.g., adult-child ratios, teachers' and children's racial-ethnic backgrounds). In another very similar study, LoCasale-Crouch and colleagues (2007) analyzed two large-scale datasets to make a profile analysis. Their sample included 15.2% of Head Start centers among 692 state-funded ECE programs. The researchers did not find any significant association according to teachers' education (i.e., whether BA and/or ECE major) and CDA certification.

There are also studies which revealed significant associations between teachers' major and classroom quality. For instance, Burchinal and colleagues (2002) conducted a study with 553 childcare classrooms and their results indicated that teachers with ECE degrees had higher scores in classroom quality (i.e., ECERS/ITERS) and child outcomes (i.e., PPVT scores). In another study, Pianta et al. (2005) examined the features of ECE settings to predict the classroom quality

and teacher-child interactions with a sample of 238 classrooms. Their results revealed that when teachers hold CDA or an associate degree and lack a bachelor's degree in ECE related fields, classroom quality was particularly lower in the classrooms with children from low-income families. Parallel to this study, Son and colleagues' (2013) study with FACES 2003 data supported that teachers who majored in ECE/CD were more socially and emotionally responsive to children and had higher classroom quality, compared to the teachers whose degree was not in these areas of study (Burchinal et al., 2002; Pianta et al., 2005; Son et al., 2013).

Given that multiple studies that included ECE teachers did not find a significant association between teachers' highest degree or the major of their degree, what other characteristics of the ECE teachers could be related to their classroom quality? The mixed associations between teachers' certification and classroom practice raised questions about potentially neglected variables in ECE settings, such as the details of teachers' PD experiences (e.g., content, frequency) and contextual factors within the center as well as the policies (Early et al. 2007; Son et al., 2013).

Teachers' Years of Experience and ECE Quality

The ECE field consists of teachers who pursue career paths with varied sequences. One group of teachers starts by earning a degree and then enters the workforce; another group enters the ECE workforce first and earns a degree later in their work life (National Research Council, 2015). The varying experience versus education sequences could lead to the mixed results mentioned above as well. In this regard, Katz (1972) identified teachers' developmental stages from the beginning of the "survival" needs during earlier times of their practice to more competent stages that develop over the years with the help of ongoing practice and experience (cited by Mims et al, 2008). Katz's stages emphasize the years of experience as an important

predictor of teachers' professional development. What do research results indicate in terms of teachers' years of experience?

Pianta et al (2006) analyzed the data from National Center for Early Development and Learning's Multi-State Pre-Kindergarten Study using hierarchical regressions among programs, classrooms, and teachers as the predicters of classroom quality (CLASS and ECERS-R scores). Their results were interesting because teachers' years of experience did not relate with the classroom quality until they included the contextual factors such as state- and program-level variables to the hierarchical regressions. Once these additional contextual factors were added to the models, teachers with more years of experience had significant higher quality classrooms, as evidenced by higher ECERS-R scores.

In another study, LoCasale-Crouch and colleagues's (2007) profile analysis indicated significant differences according to the teachers' years of experience among profiles; higher quality classrooms had teachers with longer years of experience with children. On the other hand, in a recent study, Lawrence and colleagues (2020) conducted a validation study with the newly developed Early Childhood Teacher Experiences Scale with a Head Start sample (161 teachers, 41 centers) (Lawrence et al., 2020). Surprisingly, teachers with fewer years of experience reported higher self-efficacy; and higher self-efficacy predicted better observed CLASS emotional and instructional support in the classroom. As a result, teachers' years of experience is also linked to mixed results in the literature. Therefore, the next section takes the teachers' PD experiences into account to explore whether the literature has connections to the ECE quality.

Teachers' PD Experiences and ECE Quality

Several researchers described ECE teachers' professional development (PD) as a protective factor for improving the classroom quality. Effective PD supports teachers' abilities to work with children and families. High quality PD also is associated with more positive teacher characteristics such as teachers' own professional identities, resiliency, and wages (Cassidy et al., 2019). Therefore, PD activities, as fundamental components of the ECE workforce, are represented in the literature with different samples, program types, intentions, and strategies. The literature includes a variety of studies and as was mentioned earlier, the definition of PD differs according to the intent of PD as well as the scope of each study. For this reason, some scholars attempted to conduct literature reviews and meta-analyses to categorize the studies according to their delivery strategies and content (Egert et al., 2018; Schachter, 2015; Snyder et al., 2012).

These studies indicate that commonly used PD strategies for ECE teachers include coaching, mentoring, web-mediated activities, materials, coursework, training, and professional learning communities (Schachter, 2015; Snyder et al., 2012). Furthermore, Egert et al.'s (2018) meta-analysis (n=289) indicated that majority of the studies (n=189) used multiple PD delivery strategies together. Regarding the content, Schachter's (2015) review with 73 studies showed that the most common PD contents are language and literacy (43%), social-emotional development (28%), and the combination of these two topics (10%). The rest of the studies focused on math and science (9%) and general topics (10%). In another study, Snyder and colleagues (2012) reviewed 256 PD studies with ECE teachers and they found 7.8% of these studies' content focused on classroom environment and quality. Despite the fact that these literature reviews revealed lower numbers of studies focusing on classroom quality as the intentions of PD content, Schachter (2015) argued that several experimental PD studies conduct

their pre and post-tests according to quality measures (e.g., CLASS). Therefore, several studies test the differences in classroom quality after PD interventions regardless of their content (e.g., literacy, social-emotional development).

When it comes to the Head Start context, mentoring and coaching support take an important place not only in system requirements but also in studies focusing on PD. Within this literature, there are studies that inquired about the connections between these PD activities and classroom quality. Further, CLASS is the formal measure in the Head Start monitoring system for observing the teachers' performance and quality of the classroom. Thus, several researchers approached to mentoring and coaching studies with a focus on CLASS to study the association between classroom quality and PD. For instance, Raver and colleagues (2008) provided PD for 94 Head Start teachers to support their behavior management strategies as a part of Chicago School Readiness Project. The intervention of this particular study included a behaviorally and evidence-based teacher training (i.e., Incredible Years) which lasted 30 hours (five Saturdays with 6 hours of training) over a fall and spring semester; in addition, they paired this training with weekly mental health coaching support. At the end of the intervention, ECERS-R and CLASS scores indicated significant improvement in the classroom climate and teachers' practice.

In another study, Zan and Donegan (2014) conducted an experimental study with a Head Start-University Partnership on teacher effectiveness with an intervention titled Coaching and Mentoring Preschool Quality (CAMP Quality). They designed the CAMP intervention specifically to improve Head Start teachers' CLASS performance on interactions with children with an emphasis on *Instructional Support*. They recruited 60 teachers (lead and assistant) for the eight-month long intervention which included workshops, self-reflections based on the video recordings of teachers' own practice using the frame of CLASS dimensions, peer-coaching

among the lead and assistant teachers who participated in the intervention, and monthly mentoring by Head Start supervisors to give feedback on the ongoing video recordings and self-reflections. Thus, this intervention used several PD methods to support teachers' performance in CLASS. At the end of the process, the intervention group showed significant improvements compared to the control group in four dimensions (i.e., behavior management, productivity, quality of feedback, and language modeling) and in particular, the Instructional Support domain had the stronger results. Further, the improvement patterns were similar regardless of the teachers' educational background.

In addition to these experimental designs, there are also qualitative studies that explored the Head Start workforce's perceptions about the ongoing PD activities. In a doctoral dissertation study, Harris (2016) conducted qualitative research with Head Start teachers (n=6) and education specialists (n=4) to inquire about their opinions on the ongoing PD opportunities in their context. This study involved interviews, observations during PD activities, and comparing the existing pre- and post-PD CLASS scores in Emotional and Instructional Support domains. The results indicated that Head Start teachers' PD training on Instructional Support was primarily provided via CLASS video observations, but hands-on observations seemed to be the best practice to support the teachers. The interviews also revealed that despite teachers' desire for coaching support to improve their Instructional Support scores, participants shared their concerns that they did not receive enough support in this area because of a lack of time. For the Emotional Support trainings, there were occasional mentoring and individual lesson plans; the participants' most common suggestion was to record their interactions with children and reviewing it with mentors or education specialists. Relatedly, they underlined the need of peer-mentoring by the teachers who have high CLASS scores to improve their emotional support scores. Further, in a very

similar doctoral dissertation, Amireh (2016) conducted a qualitative case study with Head Start teachers (n=7) and administrators (n=2) to investigate their perceptions about coaching. According to the results, coaching was perceived as an effective strategy to improve classroom practices, especially when paired with constructive criticism and positive feedback.

In a recent OPRE report on PD experiences of Head Start workforce, Harding and colleagues (2019B) analyzed the current FACES 2014-2018 dataset. They analyzed the program director, center director, and teacher surveys regarding available PD activities. Their results indicated, depending on agency type and size, Head Start directors and their staff had access to the PD resources such as coaching as well as training and technical assistance (T/TA) provided by Office of Head Start. The majority of the coaching opportunities provided support on child assessments and curriculum implementation.

To summarize, the ECE literature on teachers' PD interventions indicate that regardless of the intent and content of PD intervention, researchers tend to measure the impact of their interventions using quality measures. Further, common results revealed that teachers perceive the most effective PD activity when it is hands-on and paired with multiple strategies including coaching. However, there is still a gap in the literature regarding the content and quality of PD that teachers receive; also, these studies do not focus on the administrative components. Even though the current study did not explore the quality of PD activities, it aimed to explore Head Start teachers' PD opportunities in terms of the content area (i.e., curriculum and assessment), intensity of mentoring/coaching, and receiving training/technical assistance (T/TA) in relation to the classroom quality and administration of their centers.

Studies on Work Environment and ECE Quality

In addition to the teacher-related variables to predict the quality of care, as mentioned previously, according to Bronfenbrenner's PPCT model there is a need for further contextual considerations. ECE systems function on a foundation of progressive processes not only children's, but also of everyone else in the system. As classrooms and children are nested within ECE centers, these processes occur through inter-relations among people (e.g., teachers, children, program staff), within contexts (e.g., classroom, center, neighborhood), with extending over time (Dennis et al., 2013). This means that -just like any type of job- teachers do not work in a vacuum and they are affected by their work environment's general climate, system-level regulations, as well as their own internal processes. Therefore, though it is not a widely studied topic, some researchers have studied the quality of care not only as a result of teacher characteristics, but also considered the work environment (i.e., organizational climate) as a predictor of teacher's experiences, and in turn, quality of care (e.g., Bloom & Sheerer, 1992; Dennis et al., 2013; Lower & Cassidy, 2007; Yaya-Bryson et al., 2020; Zinsser & Curby, 2014).

For instance, Dennis and colleagues (2013) conducted a study with a sample of 37 centers and measured the associations between organizational climate and classroom quality. They approached the organizational climate as a collective and interactive work environment which is influenced by each worker's characteristics. They used ECERS-R to measure the classroom quality and both The Early Childhood Work Environment Survey (ECWES) (Bloom, 1992) and a revised version of The Organizational Climate Description Questionnaire for Elementary Schools (OCDQ-RE) (Hoy et al., 1991) to measure the organizational climate. ECWES brings a good deal of understanding about the components of work environment with its dimensions: collegiality, professional growth, supervisor support, clarity, reward system,

decision-making, goal consensus, task orientation, physical setting, and innovativeness. Their results indicated significant positive associations between organizational climate and classroom quality. The study also indicated strong relationships between organizational climate and more experienced teachers despite the fact they were less educated. Therefore, as it is mentioned in the previous section, Dennis and colleagues' (2013) results could shed light on the mixed results found in studies that examine the relationship between teachers' education and environmental factors. Similarly, Lower and Cassidy (2007) employed ECERS-R and ECWES; their study indicated significant positive associations between organizational climate and classroom global quality as well.

In a recent validation study for the newly developed Early Childhood Teacher Experiences Scale, the confirmatory factor analysis (CFA) showed support for a three-factor model, which includes teachers' self-efficacy, job stress, and school support (Lawrence et al., 2020). Results indicated that teachers' experiences did not significantly differ across their level of education; teachers with fewer years of experience reported higher self-efficacy; higher self-efficacy predicted better observed CLASS emotional and instructional support in the classroom. Perceived school support by teachers was related to higher quality classroom organization and instruction as well. Lawrence and colleagues (2020) discussed that Head Start teachers' PD and work environment support could seem to eliminate the gaps regarding teachers' educational background and stress factors, so teachers feel more self-efficacious and manage the classrooms in better quality. In addition, Zinsser and colleagues' studies emphasized the importance of work environment support as a factor associated with improvements in teachers' professional experiences and the classroom quality, in turn (Zinsser & Curby, 2014; Zinsser et al., 2016). Although this literature suggests that there are factors within teachers' work environment that are

related to the quality of care they provide, one very important aspect of the work environment, the center director, has not been addressed above. We turn now to consider how research suggests that center director characteristics are related to the classroom quality that teachers provide.

Studies on Center Directors and ECE Quality

When it comes to understanding the role of the program/center directors in supporting quality care and classroom quality, the literature is limited. Within this relatively small literature, there are studies which measured the administrative quality of ECE programs using the Program Administration Scale (PAS; Talan & Bloom, 2004). These studies' results indicated significant associations between observed classroom quality and programs' administrative quality (Lower & Cassidy, 2007; Yaya-Bryson et al., 2020). Further, directors' professional experiences and perceptions seem to be important factors that shape the center climate significantly which in turn may be associated with classroom quality. However, the literature also indicates that directors' workload is intense, and they experience a substantial amount of stress (Cassidy et al., 2011). Even though there is a lack of causal conclusions, a burned-out or frustrated administrator may be less effective in communication with staff, less enthusiastic about providing sufficient resources, and offer less feedback for the teachers and classrooms. In turn, multiple studies indicate that the director's approach is associated with teachers' well-being and the center's quality (Mims et al., 2008; Zinsser & Curby, 2014).

Further, the directors' level of education is a significant predictor of classroom quality as well. For instance, in Mims and colleagues' (2008) study on teacher turnover, their results indicated that the centers which had directors with higher education, also had more stable teachers and higher quality classrooms (Mims et al., 2008). Parallel to their results, in the Cost,

Quality, and Child Outcomes Study the directors' education levels were found to be the highest in high-quality centers and the lowest in low-quality centers (cited by Mims et al., 2008).

On the other hand, Zinsser and Curby (2014) conducted a study using FACES 2009 dataset to examine the associations among CLASS *Emotional Support* scores and center climate characteristics including directors' education, management practices, and job satisfaction in Head Start programs. Their results indicated that directors' education did not predict emotional support in classrooms, but prior turnover rates and directors' job satisfaction were predictors of emotional support.

In addition to the directors' education levels, lacking in-service PD activities may be linked to directors' interactions with the teaching staff as well as the classroom quality. For instance, Bloom and Sheerer (1992) conducted a 16-month Early Childhood Leadership Training Program with nine center directors within Head Start. Their intervention had an emphasis on organizational climate, and its duration was 16 months (77 training with 4-hour-length sessions). Through this leadership training covered the topics such as personal and professional self-knowledge, child development, parent and community relations, public policy, fiscal issues, and technology. After the intervention, classroom quality significantly increased in the participant directors' centers. However, findings in a recent Head Start report by Harding and colleagues (2019B) revealed that center directors are less likely to participate in some PD activities focused on higher-level leadership than program directors. Fewer center directors reported their participation in training or conferences, a network or community of leaders, and a leadership institute offered by Head Start compared to program directors (Harding et al., 2019B). At this point, it is important to remember that program directors lead the Head Start programs (grantee / delegate agency) which might operate more than one center; the center directors, on the other

hand, are responsible for leading Head Start centers and provide direct ECE services to children (Harding et al., 2019B). The focus of this study is the center directors who share the same facility with the teachers and are responsible for regulating the daily flow within the classrooms and center.

Lastly, in addition to directors' education and PD experiences their administrative and leadership skills may also be essential. In this regard, Cassidy and colleagues (2011) conducted a grounded theory study with programs which were experiencing turnover and new hiring processes during the "real-time" of these circumstances. Their results showed that programs with *proactive* directors who provided ongoing floaters in case of turnover had the least negative impact and sustained the quality compared to the r*eactive* directors with multiple substitute teachers during the transition process. Therefore, in the centers with proactive directors, the impact on children and families was less noticeable during the transition, and also new teachers made the transition more smoothly. These results support the importance of contextual factors during turnover, similar to a *domino effect* (Cassidy et al., 2011) on teachers, children, families, quality of practice, and center climate.

In summary, this literature review provided information about the quality definitions, measurement, and Head Start policies, making connections to the regulations and research results regarding teachers and center directors. Overall, the relevant studies which explored teachers' characteristics and classroom quality associations seem to be mixed, and there is a lack of evidence related to directors, which prevents us from making solid conclusions. Therefore, in light of this background information, the next chapter presents the aims and research questions of the current study.

CHAPTER IV: THE CURRENT STUDY

Aims

As discussed in the previous chapters, classroom quality is interrelated with several contextual variables within ECE settings. Even though the existing literature helps in understanding some of these associations, there are still apparent gaps and a need to unpack these contextual variables. In particular, the Head Start literature includes notable mixed results regarding the associations between workforce characteristics and quality care. Further, there is little known about the roles of ECE center directors' characteristics in relation to the teachers and classroom quality. Therefore, the current study focused on the professional experiences of the Head Start teachers and center directors as predictors of classroom quality from a multi-level perspective.

Research Questions and Hypotheses

This study conducted quantitative analyses using the FACES 2014 study's Spring 2015 data. Descriptive statistics and hierarchical linear modeling (HLM) were used primarily with an exploratory approach to predicting the Head Start classroom quality. One research question with sufficient literature included a specific hypothesis, but additional questions addressing associations with limited literature support were exploratory and did not have a hypothesis. Each research question and the hypothesis (as appropriate) are listed below.

RQ1. Which characteristics (i.e., highest degree, field of the degree) and professional experiences (i.e., years of experience, the intensity of PD in curriculum, assessment, and mentoring, participation to T/TA) of teachers are predictors of classroom quality across the Head Start centers?

- RQ1.a. Which characteristics and professional experiences of teachers are predictors of the Emotional Support domain of CLASS?
- RQ1.b. Which characteristics and professional experiences of teachers are predictors of the Instructional Support domain of CLASS?
- RQ1.c. Which characteristics and professional experiences of teachers are predictors of the Classroom Organization domain of CLASS?

Considerations for hypotheses of the first set of questions: Results from the literature on teachers' educational background and years of experiences are quite mixed. Several studies suggest that teachers' professional development activities are associated with improved classroom quality. These studies generally mentioned the importance of duration and intensity; however, they did not unpack the results regarding the content and quality of PD activities. Similar to these studies, the current study focuses on intensity of teachers' in-service PD experiences. The first set of questions aimed to both contribute to the explorations in the literature and confirm findings from existing studies. In this regard, these questions use an exploratory approach to the teachers' education, field of education, and years of experience, while hypothesizing the intensity of teachers' PD activities in curriculum, assessment, and mentoring, as well as T/TA participations as predictors of the quality of classroom (i.e., CLASS domain scores) across the Head Start centers.

H1 / H1.a / H1.b / H1.c: Higher numbers of reported PD hours, participation to T/TA, and reported intensity of mentoring predicts higher levels of CLASS (i.e., Emotional Support, Instructional Support, and Classroom Organization domains) scores.

RQ2. Which characteristics (i.e., highest degree, field of degree) and professional experiences (i.e., years of experience, workload related to teachers, management challenges, PD participation) of directors are predictors of classroom quality across the Head Start centers?

- RQ2.a. Which characteristics and professional experiences of directors are predictors of the Emotional Support domain of CLASS?

- RQ2.b. Which characteristics and professional experiences of directors are predictors of the Instructional Support domain of CLASS?
- RQ2.c. Which characteristics and professional experiences of directors are predictors of the Classroom Organization domain of CLASS?

Considerations for hypotheses of the second set of questions: When it comes to the administrative processes and center director characteristics, there is relatively limited literature. Very few studies have examined whether higher administrative quality, directors' educational background, and PD participation are associated with the higher classroom quality. Therefore, this scarce literature did not yield to a confirmatory study, and the current research questions to contribute to this literature with exploratory results rather than addressing a hypothesis.

RQ3. How do the center directors' characteristics (i.e., highest degree, field of degree) and professional experiences (i.e., years of experience, workload related to teachers, management challenges, PD participation) moderate the associations between teachers' in-service PD experiences (i.e., PD hours in curriculum and assessment, intensity of mentoring, participation to T/TA) and classroom quality?

- RQ3.a. How do the center directors' characteristics and professional experiences moderate the associations between teachers' in-service PD experiences and the Emotional Support domain of CLASS ?
- RQ3.b. How do the center directors' characteristics and professional experiences moderate the associations between teachers' in-service PD experiences and the Instructional domain of CLASS?
- RQ3.c. How do the center directors' characteristics and professional experiences moderate the associations between teachers' in-service PD experiences and the Classroom Organization domain of CLASS?

Considerations for the third set of questions: The last set of questions provided more holistic approach to the previous questions in light of Bronfenbrenner's PPCT model. It aimed to explore whether center directors' professional experiences including their highest degree, years of experience, and workload moderate the associations between teachers' in-service PD experiences and classroom quality. Because there is limited research literature examining the

relationships among teachers, center directors, and classroom quality, these research questions are exploratory, and no hypotheses are offered.

CHAPTER V: METHOD

As mentioned in the previous chapter, this study conducted a secondary dataset analysis using FACES 2014 data. This chapter provides an initial introduction to this dataset and continues with the current study's methodology in terms of sampling, variable selection and data collection tools, and analysis plan.

Introduction to the Data Source: FACES

This study analyzed data from the latest Head Start Family and Child Experiences Survey (FACES) 2014 data. FACES is a nationally representative data collection effort by the Administration for Children and Families (ACF). Beginning in 1997, FACES data has continued to be collected to describe changing demographic information of participants and staff and trends in performance and program quality (Klein et al., 2018). FACES data collection typically extends across multiple years. For instance, FACES 2014 data collection occurred in three periods (Fall 2014, Spring 2015, Spring 2017). Expectedly, these long data collection periods allow the researchers to employ comprehensive data collection efforts with multiple components/surveys. Each data collection wave uses tools to measure different aspects of the Head Start program such as children's development, qualifications and perceptions of staff, and classroom quality. Thus, the FACES data provide a comprehensive descriptive picture regarding Head Start programs. The datasets are publicly available to promote additional research focused on Head Start.

The Current Study

The current study aimed to explore teacher characteristics and the contextual dynamics of centers with an emphasis on directors' characteristics and experiences as predictors of Head Start classroom quality. In this regard, the Core Teacher and Core Director Surveys, as well as the

CLASS observation data within the Core Classroom Study data from the FACES 2014, Spring 2015 dataset were analyzed (please see Appendix A for further information about FACES 2014 design). In the next section sampling design, analysis sample, measures/variables, and analysis plan for the data used in the current study are described.

Sampling Design of FACES 2014 and Analysis Sample

The FACES 2014 data collection employed a multi-stage sampling design to ensure a nationally representative sample. Sampling was carried out in four stages, including the selection of Head Start programs, centers within programs, classrooms within centers, and finally, children within classrooms. During this complex sampling process, to prevent unequal variance estimates, in the first two stages of selection (programs and centers) the probability proportion to size (PPS) technique was used to recruit a weighted and balanced sample structure (Hahs-Vaughn et al., 2011; Klein et al., 2018). Further, in the same steps, sequential sampling technique was employed to prevent selection bias by selecting each *n*th case after a random start (Klein et al., 2018). Following these first steps, FACES 2014 aimed for equal number of sampling for the remaining stages (classroom and children). In this regard, sampling procedures included explicit (e.g., program characteristics) and implicit selection (e.g., population characteristics) criteria. Even though the current study's sample included only centers and classrooms/teachers, in FACES 2014, initially Head Start program selection occurred, and this step determined the current study's sample. For this reason, the Head Start program, center, classroom, and teacher selection processes for FACES 2014 as well as the current study are explained in the next subsections.

Selection of Head Start Programs

The Head Start Program Information Report (PIR) database from 2012-2013 Head Start year provided a list of 2900 programs across the country. Several types of programs were deemed ineligible for the FACES study and excluded from the sample, including programs from Puerto Rico and other U.S. territories; American Indian and Alaska Native and Migrant and Seasonal Head Start programs; programs that do not provide services to children in the target age group; and defunded programs and programs temporarily not serving children.

Once the group of eligible programs was identified, explicit selection criteria were considered including programs' size to assure selected programs were large enough for the classroom selection process, census region, urbanicity, and enrollment rates of racially/ethnically minority population. In the next step, implicit criteria were applied, including the percentage of dual language learners and children with disabilities, and ACF region, as well as the program status as a school district grantee (Klein et al., 2018, pg. 54).

Selection of Centers/Directors

From the list of selected programs, two centers were randomly selected from each program. At this stage, no explicit selection criteria were used for the original FACES sample. In total, FACES 2014 sample involved 347 centers/directors.

Selection of Classrooms/Teachers

Field Enrollment Specialists (FES) investigated each center's classroom size, type (e.g., morning, afternoon), and teachers. This information was used for the selection process. A systematic sample of two classrooms from each center was selected. This selection occurred according to the teachers' last names as implicit criteria to make sure that each teacher was selected only one time. For the centers with only one or two classrooms, FES included all

classrooms (Klein et al., 2018, pg. 57). In total, sample included 691 classrooms/teachers, however, in order to prevent statistical issues in HLM analysis (e.g., centering), the centers with at least two classrooms were included in the analysis sample (also see Analysis Planning section, pg. 63). Thus, 45 centers with only one classroom were excluded, and the analysis sample consisted of 302 centers/directors and 646 classrooms/teachers.

Table 1. Number of Participants in FACES Spring 2015 and Analysis Sample for the Current Study

	Spring 2015	Analysis Sample
Centers	347	302
Classrooms / Teachers	691	646

Within these stages, the current study represents the second (center selection) and third (classroom/teacher selection) stages of the sampling process of the Spring 2015 sample. The demographics of the analysis sample for the current study is provided in Table 2.

Table 2. Analysis Sample Demographics

Level-2			Level-1					
Directors(n=302)			**Teachers (n=646)**			**Classrooms (n=646)**		
Highest Degree	**Valid N**	**%**	**Highest Degree**	**Valid N**	**%**	**Classroom size during observation**	**Valid N**	**%**
Less than Associate's degree	10	3.6	Less than Associate's degree	16	2.8	2-8	24	4.2
Associate's degree	43	15.4	Associate's degree	137	23.2	9-13	258	43.1
Bachelor's degree	122	43.7	Bachelor's degree	291	49.2	14-17	272	45.5
Graduate and professional degrees	104	37.2	Graduate and professional degrees	147	24.7	18+	43	7.2
Field of Highest Degree	**Valid N**	**%**	**Field of the Highest Degree**	**Valid N**	**%**	**CLASS score**	**Mean**	**S.D.**
Early Childhood Education	110	41.5	Early Childhood Education	294	50.4	Instructional Support	2.44	.84
Child Development and developmental psychology	30	11.3	Child development and developmental psychology	60	10.3	Emotional Support	5.43	.55
Elementary education	20	7.5	Special Education	19	3.3	Classroom Organization	4.71	.74
Educational Administration/Management & Supervision	30	11.3	Elementary Education	81	13.9			
Other	75	28.4	Other	129	22.1			
Years of experience	**Valid N**	**%**	**Years of experience**	**Valid N**	**%**			
0-5	104	37.3	0-5	125	21.2			
6-10	71	25.4	6-10	116	19.6			
11-15	36	12.9	11-15	101	17.2			
16+	68	24.4	16-20	101	17.1			
			21+	147	24.9			
Gender	**Valid N**	**%**	**Gender**	**Valid N**	**%**			
Female	265	94.6	Female	575	97.1			
Male	15	5.4	Male	17	2.9			
Race	**Valid N**	**%**	**Race**	**Valid N**	**%**			
White	164	58.6	White	345	59.6			
Black or African American	87	31.1	Black or African American	178	30.7			
American Indian, Alaska Native	8	2.9	American Indian, Alaska Native	12	2.1			
Asian or Pacific Islander	8	2.9	Asian or Pacific Islander	21	3.6			
Other	10	3.6	Other	40	6.9			
Spanish, Hispanic, or Latino origin	**Valid N**	**%**	**Spanish, Hispanic, or Latino origin**	**Valid N**	**%**			
Yes	45	16.2	Yes	132	22.4			
No	233	83.8	No	457	77.6			

Variable Selection and Data Collection Tools

The current study examined the predictions of classroom quality in relation to teacher and director characteristics. It is important to note that the Core Classroom, Teacher, and Director data were collected in both Spring 2015 and Spring 2017. In each of these years, there were slight differences in the director surveys. Considering each year's survey content and the center director data gathered, the current study used the Spring 2015 FACES CLASS data, and teacher and director survey data. However, because the teacher and director surveys included several subsections and questions that are not relevant for the current study, not all of the survey information is used in the current study. The following sections describe the surveys and questions used in the current study.

Core Classroom Observation Instruments

The current study used the Pre-K Classroom Assessment Scoring System (CLASS; Pianta et al., 2008) observation data as the classroom quality scores from the Core Classroom data. CLASS is the formal quality measure within the HSPPS and quality monitoring system of Head Start. For this reason, the FACES Spring 2015 CLASS domain scores are the outcome variables of classroom quality.

The CLASS is used to assess overall process quality in the classroom with an emphasis on teacher-child interactions in a relation to children's social and academic competencies in early childhood classrooms (Pianta et al., 2008). This measure includes three broad domains: Emotional Support, Classroom Organization, and Instructional Support. Each dimension within the domain is scored in a seven-point scale from one (minimally characteristic) to seven (highly characteristic). The domain scores are used as variables in the current study. Descriptions of each

domain and the dimensions within each domain are provided below to facilitate understanding of the constructs addressed within the domains.

The Emotional Support domain involves four dimensions including Positive Climate, Negative Climate, Teacher Sensitivity, and Regard for Student Perspectives. This domain's internal consistency (i.e., Cronbach's alpha) as reported by the instrument's authors is .89 (Pianta et al., 2008), and in the FACES 2009 data Chronbach's alphas ranged from .80 to .82 (Klein et al., 2018). The Classroom Organization domain includes three dimensions: Behavior Management, Productivity, and Instructional Learning Formats. The authors reported Cronbach's alpha as .77, and in the FACES 2009, it ranged between .77 to .79. Lastly, the Instructional Support domain consists of three dimensions: Concept Development, Quality of Feedback, and Language Modeling. The authors reported Cronbach's alpha of .83 for this domain, and in the FACES 2009 data it ranged from .87 to .90 (Klein et al., 2018; Pianta et al., 2008). For ensuring the reliability, field staff attended trainings, including lectures and three 20-minute observations followed by coding. If they ended the observations with .80 agreement with the gold-standard observer's results, they passed the training (also see Procedures section, pg. 62).

Core Teacher Surveys

Core Teacher data were collected using web-based and paper surveys; the questions focused on teacher characteristics such as demographic information, educational background, professional development activities, teaching experiences, and feelings about teaching and their Head Start program. Surveys focused on five areas: classroom session type, classroom activities, teacher experiences, feelings, and background information. From the five areas in teacher surveys, the questions related to teachers' background (i.e., years of experience, education) and PD experiences were used in the current study.

In terms of background information, years of experience, highest degree, and field of highest degree variables were the questions included in the current analysis. Answers to the *"in total, how many years have you been teaching (including all grades and preschool)?*" referred to years of experience. The "*what is the highest grade or year of school that you completed?"* question provided 13 different options from up to 8th grade through doctorate degree. For analysis purposes, these options were recoded into three categories, including less than Bachelor's degree, Bachelor's degree, and higher than Bachelor's degree. Further, the "*in what field did you obtain your highest degree?"* question provided several options for the respondents; these options were recoded into two categories, including ECE/Child Development related degrees and Other fields. Following these categorizations, these variables were used in dummy coded formats in the analysis.

Another sub-section of the Core Teacher Surveys included questions regarding in-service PD experiences of teachers. These experiences were measured in different questions in FACES 2014: 1) PD activities in curriculum, 2) PD activities in assessment, 3) mentoring and coaching experiences, and 4) Training/Technical Assistance (T/TA). The current study focused on the questions regarding the intensity and frequency of teachers' in-service PD experiences in the last year. These questions were phrased as "*how many hours of training (in curriculum and assessment) have you had in the past 12 months?"* (open-ended question). The responses were included in the analysis in a continuous variable format without re-computations.

Another section asked teachers whether they have a mentor or coach (yes/no), and if yes, how often their mentor/coach comes to their classroom (*once a week or more (1)* to *less than a month (4)*). In order to include these responses in the analysis, first, for teachers who answered the prerequisite question as "*no*," the intensity was recoded as "*none*" and added as a fifth option

as an intensity level for mentoring/coaching. This recoding allowed these responses to be included as data for this question. Lastly, the responses were reverse coded as one (1) for none, and five (5) as the highest intensity.

One last question regarding in-service PD experiences pointed to the T/TA participation and asked "*have you participated in training or technical assistance activities with state T/TA specialists?*" with providing responses in three categories: *yes*, *no*, and *I don't know*. These options were included in the analysis after dummy coding.

Core Center Director Surveys

FACES Spring 2015 Core Center Director Surveys included questions regarding center staff demographics, qualifications, and ongoing PD activities. Similar to the Core Teacher survey, director surveys consisted of six domains: staffing and recruitment, staff education and training, curriculum and assessment, overview of program management, use of program data and information, and employment and educational background information. Each domain consisted of varied subsections and question structures (e.g., open-ended, multiple choice, Likert-type) to gather data about center directors' qualifications, background information, and ongoing PD activities. The questions used in the current study took place in the *employment and educational background* and *overview of program management* domains.

The *employment and educational background* domain included several sub-surveys regarding directors' demographics, educational background, and professional experiences. The "*what is the highest grade or year of school that you completed?"* question provided 13 different options from up to 8th grade through doctorate degree; these options were recoded into three categories, including less than Bachelor's degree, Bachelor's degree, and higher than Bachelor's degree. Further, the *"in what field did you obtain your highest degree?"* question provided

several options for the respondents. For the analysis purposes, these options were recoded into two categories, including ECE/Child Development related degrees and Other fields. Following these categorizations, these variables were used in dummy coded formats in the analysis. Years of experience was asked in an open-ended question format and the responses for this were used in the analysis as a continuous variable.

The same domain asked directors whether they have participated in certain types of PD activities in the last 12 months. This question provided six different types of PD activities (e.g., formal mentoring or coaching, a leadership institute offered by Head Start) and structured as a yes/no answer format. In order to use this variable, the researcher computed the total number of "yes" answers to have a total number of PD activities that directors attended.

In addition to these questions, this domain included an 11-item survey on *directors' perceived management challenges,* and asked directors to indicate how much specific tasks make their job harder, and the responses were provided in a three-level Likert-type format (i.e., great deal harder, somewhat harder, not at all harder). The items include "too many conflicting demands", "staff turnover", and "lack of qualified teaching staff." A mean score from this survey was computed and used in the analysis.

Directors' workload related to teachers. One of the surveys which was included in the analysis took place the *overview of program management* domain, asked how much of their time is needed for certain responsibilities as a center director. This survey consisted of twelve items with a four-level Likert-type format ranged from a lot of my time (1) to none of my time at all (4). Workload questions includes questions focused on "dealing with human resources issues," "designing the training and technical assistance plan for this program," and "fiscal management." Among the twelve items, three items which were most relevant to teachers were chosen to be

included in analyses. These items included “designing the training and technical assistance plan for this center,” “evaluating teacher and other staff,” and “providing educational leadership/establishing the curriculum.” Before including these items in the analysis, first, the responses were reverse coded so that the least amount of time was coded as 1. As a second step, a mean score was computed from these three items and included in the analysis as the “teacher-related workload” variable.

Control Variables

Besides the dependent and independent variables, the analysis included certain control variables at both classroom and center-levels. For class-level, class size and adult/child ratio during the CLASS observations. Quality has several components as mentioned in the literature review, and these two variables could easily relate to the classroom dynamics and efficiency of teacher-child interactions. In the literature, several studies indicated consistent associations between these two variables and classroom quality scores as well. Thus, it was important to control for these two variables and they were included besides teacher-related variables. As for level-2, only center-level control variable was the number of lead teachers in the center. This was considered and included in the analysis because it is a proxy for the size of the centers, and the directors’ workload and perceptions could be in relation to center size. Controlling for number of lead teachers helped to take this center-level variability into account, in a very similar way to the class size.

Procedures

FACES data collection teams administered the data collection process. Field Enrollment Specialists (FESs), team leaders, and observers were responsible for administering the CLASS observations and staff surveys (Klein et al., 2018, pg. 133). CLASS data collection procedures

started with field staff's training on the measure. This training included lectures and three 20-minute observations followed by coding. If they ended the observations with .80 agreement with the gold-standard observer's results, they passed the training. Forty-eight of the sixty-one trainees were certified at the end of the training for the Spring 2015. The observations were conducted by trained observers as well as the cross-trained FESs and team leaders. The on-site observations occurred starting from week four through ten of the Spring 2015. Each classroom observation took four hours to complete.

Data collection from teachers and center directors occurred between March to May 2015. Everyone had the online and paper survey options. The web-based surveys were developed in Blaise and WebSurv and shared with the participants. When teachers and directors needed the paper version, the surveys were administered by either team leaders or observers during their center visits for classroom observations. At the end of each week, team leaders shipped the collected paper surveys to Mathematica's Survey Operation Center. The teacher survey took about 30 to 35 minutes, and the director surveys took 25 minutes to complete.

Analysis Plan

Descriptive statistics and data cleaning

Prior to the HLM analysis, variables from both Spring 2015 Core Teacher Survey and Core Center Director Survey data's descriptive analyses were conducted to see the distributions as well as any potential cleaning and new computations.

First, the descriptive statistics highlighted that, within the sample, there were 45 centers with only one classroom. After comparing these 45 centers with the analysis sample using Cohen's d effect size computations (Social Science Statistics, n.d.; see Appendix D) the results indicated negligible differences (0-.46). The only exception was the center-level control variable

-number of lead teachers, which indicated a strong difference (d=.89) compared to the analysis sample. However, since it was not a main study variable and the only intention was to control for the proxy of the center size, this variable was still used in the analysis sample regardless of the Cohen's d magnitude. After confirming that there was not potential fundamental data loss, in order to prevent issues in HLM analysis (e.g., centering), the clusters with at least two classrooms were included. Thus, the analysis sample consisted of 302 centers/directors and 646 classrooms/teachers.

Second, the descriptive and frequency statistics for each variable were examined. In light of these descriptive results, certain variables required new computations as well as recoding/dummy coding steps before placing them in the HLM efficiently. These variables (i.e., intensity of mentoring/teaching that teachers received, directors' workload related to teachers, perceived management challenges, PD participation within the last year, and both teachers' and directors' highest degree, field of highest degree) and their new computations are provided previously in the variable selection and data collection tools section.

Lastly, the descriptive statistics indicated that six center directors reported the number of lead teachers in their centers as zero (0). On the contrary, teacher data existed for these centers. Therefore, the six center directors' responses for the number of lead teachers were considered as missing. The final descriptive statistics of the study variables are provided in the Results chapter. Overall, for all of these initial steps prior to the HLM analysis, the researcher employed IBM SPSS for Windows, Version 26 to clean and recode the relevant variables.

HLM Analysis

The research questions of this study were examined using Hierarchical Linear Modeling (HLM) using HLM 8.00 software. HLM is a linear model that considers the nested structure of

the data, which is neglected in regular ordinary least squares (OLS) regression analyses (Raudenbush & Byrk, 2002; Woltman, 2012). HLM considers group-level commonalities and shared variances, which results in an advantage over regular OLS regression when analyzing nest data. A nested data structure occurs when there are "units of analysis" in the dataset at different levels. These levels are defined according to the hierarchy of the units are located; the lowest level of the hierarchy refers to level-1, which are nested in the higher level (level-2) (Woltman, 2012). In the current study, the classrooms (and corresponding teachers) are nested within each of the Head Start centers. Thus, classrooms/teachers refer to the level-1 units and the centers/directors are considered at level-2 units, which is also referred as a cluster as it holds the classrooms/teachers under their umbrella at level-1 units. In nested samples, each level-1 unit shares some commonalities of their affiliated level-2 unit. In this data set, it was expected that two (on average) classrooms within the same center would have similarities that were not shared between two classrooms from different centers. This commonness often results in associations that are not accounted for by a traditional regression analysis. To address these, HLM analyses partition the unexplained variation into variation of level-1 units within a level-2 group (i.e., variability between classes within center) and variation between level-2 groups (i.e., variability between centers). In doing so, HLM accounts for dependencies within the data. In OLS regressions, the nested structure is ignored by employing either a disaggregation or an aggregation approach, which increases the risk of Type-1 error, and HLM eliminates this risk (Hox & Roberts, 2011; McNeish & Stapleton, 2016; Raudenbush & Byrk, 2002; Woltman et al., 2012).

Estimation

Another consideration before starting the actual data analysis was to decide the type of HLM estimation. HLM software provides two estimation options: full information maximum-likelihood (FIML) or restricted maximum likelihood (RML) estimations. FIML is an ideal approach when there are sufficient number of clusters; on the other hand, RML estimations are ideal when the number of groups is small (generally referred as less than 30) (Boedeker, 2017; McNeish & Stapleton, 2016). In this regard, literature does not refer to a standard number for ideal group and individual numbers. For instance, depending on the research design (e.g. longitudinal, cross-level interactions) different guidelines recommend different numbers such as minimum 30 clusters including 30 individual units within each cluster; 20 clusters with 20 individual units; 100 clusters with 10 units (Altun et al., 2018; McNeish et al., 2016; Woltman et al., 2012). In this analysis sample, there are 302 Head Start centers and, on average, 2 classrooms/teachers from each cluster (n=646). Therefore, FIML estimations were employed during the set-up of analysis. This method led to less biased parameter estimates and prevented data loss that would occur with listwise deletions (Acock, 2005; Little et al., 2014).

Weighting

In complex datasets such as FACES, the ratio of clusters and units is a challenge in terms of creating disproportionate sampling. To prevent unequal representations and unequal sampling issues, the weighted variables provided by FACES datasets were helpful (Hahs-Vaughn et al., 2011). As a preliminary step, the weighting variable was selected. The FACES 2014 user guide recommended to use level-1 weighting data for multi-level analysis. FACES dataset provides several weighting variables according to researchers' potential use of variables (e.g., child data, family data, center data). Since this study used both classroom observation data and teacher

survey data, recommended *TO2CLSWT* weights were used in the analysis (Klein et al., 2018, pg. 224).

Centering

Lastly, the researcher considered *centering* as needed in the model according to the measurement tools' scaling structure. If a measure does not include a meaningful zero in its scale, then HLM benefits from centering to adjust the scale for accurate results (Enders & Tofighi, 2007; Raudenbush & Byrk, 2002). Centering at level-2 (i.e., center/director-level) is usually not problematic because the only option is the grand mean centering. However, centering decision at level-1 (i.e., classroom/teacher-level) requires a choice of centering either at group or at grand-mean depending on research questions and variables. Ender and Tofighi (2007) recommended group-mean centering when level-1 predictor or an interaction are of substantive interests. In the current study's case, for the first set of research questions, teacher-level (i.e., level-1) predictors are the main interest of the study in order to predict classroom quality. Group-mean centering helps to provide a relatively pure, unbiased within-cluster estimate (Enders & Tofighi, 2007, pg. 128; Raudenbush & Byrk, 2002, pg. 139). For the third research question set, cross-level moderation effects were tested, and similar to the previous case, group-mean centering at level-1 produces unbiased estimates (Enders and Tofighi, 2007, pg. 133). Thus, with the help of these considerations, all classroom/teacher related variables were group-mean centered, and all the center/director level variables were grand mean centered.

Models for Each Research Question

After data preparation and preliminary decisions, hierarchical linear models were tested in three steps: fully unconditional, multi-level mixed models for testing main predictors, and multi-level mixed models for testing cross-level moderations. For these models, CLASS scores

were the dependent variables and represented the classroom/teacher-level (i.e., level-1). In the mixed models, level-1 variables included dependent and independent variables, and testing them with HLM helped explain the within center variability (i.e., level-2). In addition, for testing the between centers variability at level-2, director-related variables were added to the models. The significance level for the estimates was defined as $p<.05$.

Table 3. Study Variables

Outcome Variables (Level-1)	**Teacher-level Variables (Level-1)**	**Director-level Variables (Level-2)**
CLASS – Emotional Support Domain	Years of experience	Years of experience
CLASS – Instructional Support Domai	Highest degree	Highest degree
CLASS – Classroom Organization	PD hours in curriculum	PD participation in the last year
	PD hours in assessment	Teacher related workload
	Intensity of mentoring/coaching	Perceived management challenges ("How much do the following make it harder for you to do your job well?")
	T/TA	
	Control variables: Class size and Child/Adult Ratio	Control variable: Number of lead teachers in the center

First, the fully unconditional, one-way random effects ANOVA model was used as a preliminary step. This sub-model was helpful for assessing the variability of the three outcome variables (CLASS domain scores) across centers. At this step, the models did not include any level-1 or level-2 predictors.

Level 2 (Center/Director-level): $\beta_{0j} = \gamma_{00} + u_{0j}$ [1.1]

Level 1 (Classroom/Teacher-level): Classroom Quality$_{ij} = \beta_{0j} + r_{ij}$ [1.2]

Table 4. Guideline for Each Parameter in the Model Equations

Classroom Quality$_{ij}$ (Y_{ij}): Dependent variable measured for *i*th level-1 unit nested within the *j*th level-2 unit.
β_{0j}: Intercept for the *j*th level-2 unit
B_{qj}: Slope of each level-1 predictor for the *j*th level-2 unit
γ_{00}: Overall mean intercept
γ_{q0}: Regression coefficient associated with each level-2 variable relative to level-1 intercept
γ_{q1} - γ_{q8}: Regression coefficient associated with each level-2 variable relative to level-1 slope
u_{0j}: Random effects of the *j*th level-2 unit
r_{ij}: Random error associated with the *i*th level-1 unit nested within the *j*th level-2 unit

(Reference: Woltman et al., 2012, pg. 57)

The result of this step provided hypothesis testing with respect to the estimation about the grand mean of the outcome variable, in addition to information about the degree of dependence (intraclass correlation) within level-2 outcome estimation (Raudenbush & Byrk, 2002; Woltman et al., 2012). Intraclass correlation (ICC) is the proportion of variance in the outcome variable that is attributable to the level-2 clusters (e.g. centers); for this reason, it is also referred to as a cluster effect. ICCs for each outcome variable were computed according to fully unconditional model results to conclude dependency in the grouping variables (i.e., ICC > 0) (Huang, 2018; Raudenbush & Byrk, 2002, p. 36).

FACES 2014 has adequate number of clusters, however, the cluster sizes are smaller than 10 in each center. With a consideration of the HLM assumptions due to the cluster sizes (i.e., there are very few classrooms in each center), random slopes were not included in the models. In light of this, following the fully unconditional model, for each research question multi-level mixed models were tested by including teacher-level and/or director-level covariates depending on the research question.

RQ1 (a,b, & c) - Which characteristics and professional experiences of teachers are predictors of classroom quality across the centers?

In order to test the first set of research questions, teacher-level (level-1) variables were placed to the model for predicting the classroom quality scores across the Head Start centers (see Table 3 for the given variables). The results of this step provided information of which variables are significant predictors of each CLASS domain (i.e., emotional support, instructional support, and classroom organization).

RQ2 (a, b, & c) - Which characteristics and professional experiences of directors are predictors of classroom quality scores?

For the second set of research questions, the goal was to test the relationship between directors' characteristics as the level-2 predictors and Head Start classroom quality (i.e., three CLASS domains) as the outcome variable (see Table 3 for the given variables). Therefore, the first two sets of research questions were tested in one multilevel mixed model per each outcome variable.

Level-1 Model

$$\text{Classroom Quality}_{ij} = \beta_{0j} + \beta_{1j}*(\text{Class size}_{ij}) + \beta_{2j}*(\text{Child/Adult}_{ij}) + \beta_{3j}*(\text{PD hours in curriculum}_{ij}) + \beta_{4j}*(\text{PD hours in assessment}_{ij}) + \beta_{5j}*(\text{Years of experience}_{ij}) + \beta_{6j}*(\text{Intensity of monitoring}_{ij}) + \beta_{7j}*(\text{No T/TA}_{ij}) + \beta_{8j}*(\text{I don't know T/TA}_{ij}) + \beta_{9j}*(\text{Less than BA}_{ij}) + \beta_{10j}*(\text{Higher than BA}_{ij}) + \beta_{11j}*(\text{No ECE/CD degree}_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(\text{Number of lead teachers}_j) + \gamma_{02}*(\text{Years of experience}_j) + \gamma_{03}*(\text{PD participation}_j) + \gamma_{04}*(\text{Management Challenges}_j) + \gamma_{05}*(\text{Less than BA}_j) + \gamma_{06}*(\text{Teacher related workload}_j) + \gamma_{07}*(\text{No ECE/CD degre}_j) + \gamma_{08}*(\text{Higher than BA}_j) + u_{0j}$$

$$\beta_{qj} = \gamma_{q0}$$

RQ3 (a, b, & c) - How do the center directors' characteristics and professional experiences moderate the associations between teachers' ongoing in-service PD experiences and classroom quality scores?

Lastly, the third set of research questions aimed to test the moderation effect of director-related variables on the association between teacher-related factors and classroom quality. In order to answer these questions, multi-level mixed models were used to test the moderations using the CLASS domain scores as dependent variables in three separate models.

Level-1 Model

$$\text{Class Quality}_{ij} = \beta_{0j} + \beta_{1j}*(\text{PD hours in curriculum}_{ij}) + \beta_{2j}*(\text{PD hours in assessment}_{ij}) + \beta_{3j}*(\text{Intensity of mentoring}_{ij}) + \beta_{4j}*(\text{No T/TA}_{ij}) + \beta_{5j}*(\text{I don't know T/TA}_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(\text{Number of lead teachers}_j) + \gamma_{02}*(\text{Years of experience}_j) + \gamma_{03}*(\text{PD participation}_j) + \gamma_{04}*(\text{Management Challenges}_j) + \gamma_{05}*(\text{Less than BA}_j) + \gamma_{06}*(\text{Teacher related workload}_j) + \gamma_{07}*(\text{No ECE/CD degree}_j) + \gamma_{08}*(\text{Higher than BA}_j) + u_{0j}$$

$$\beta_{qj} = \gamma_{q0} + \gamma_{q1}*(\text{Number of lead teachers}_j) + \gamma_{q2}*(\text{Years of experience}_j) + \gamma_{q3}*(\text{PD participation}_j) + \gamma_{04}*(\text{Management Challenges}_j) + \gamma_{q5}*(\text{Less than BA}_j) + \gamma_{q6}*(\text{Teacher related workload}_j) + \gamma_{q7}*(\text{No ECE/CD degree}_j) + \gamma_{q8}*(\text{Higher than BA}_j)$$

In summary, HLM is an advantageous technique for more accurate conclusions in nested sample structures. FACES Spring 2015 data provides a nested data structure as the surveys come from different stakeholders (e.g., teachers, directors). While doing this, for exploring the predictors of classroom quality, in addition to teachers' characteristics and professional experiences, the center director-related variations were considered as contextual predictors.

CHAPTER VI: RESULTS

Three overarching research questions seek to identify which teacher and director characteristic are predictors of classroom quality as measured by the CLASS domains (i.e., Instructional Support, Emotional Support, Classroom Organization). Therefore, HLM was used to examine each CLASS domain independently since they are considered as separate outcomes (dependent variables) in the study. Results are organized by the three overarching questions, and within each question results are provided for all three CLASS domains. Prior to these primary results, preliminary results are provided as well.

Preliminary results

As mentioned in the analysis plan section, the first attempt for the analysis was organizing the variables and exploring the descriptive statistics. These preliminary steps provided the descriptive results for all the study variables which took place in the HLM models (see Table 5).

Table 5. Descriptive Statistics for Study Variables

Level-1 Descriptive Statistics (Classroom/Teacher)					
Variable Name	**N**	**Mean**	**Sd**	**Min**	**Max**
[Weighting variable: TO2CLSWT	*553*	*76.74*	*62.04*	*8.43*	*483.79]*
Outcome variables					
CLASS Instructional Support	596	2.44	0.85	1.00	6.33
CLASS Emotional Support	596	5.43	0.56	2.83	7.00
CLASS Classroom Organization	595	4.71	0.74	2.58	6.78
Teachers as main predictors					
Teachers' in-service PD experiences in the last 12 months					
PD hours in curriculum	397	13.02	20.92	0.00	192.00
PD hours in assessment	404	8.36	11.49	0.00	100.00
Intensity of mentoring/coaching	545	2.79	1.45	1.00	5.00
T/TA					
Did not receive T/TA	256 (47.1%)				
Received T/TA	121 (22.3%)				
Do not know if received T/TA	166 (30.6%)				
Teachers' educational background					
Years of experience	590	14.17	8.75	0.00	30.00
Highest degree					
Less than BA degree	153 (25.9%)				
Ba degree	291 (49.2%)				
Higher than BA degree	147 (22.8%)				
Field of highest degree is ECE/CD	354 (60.7%)				
Classroom-level control variables (for RQ1 and 2)					
Class Size	598	13.86	2.72	2.00	20.00
Child/Adult Ratio	598	6.03	1.76	1.00	17.00
Level-2 Descriptive Statistics (Center/Director)					
Variable Name	**N**	**Mean**	**Sd**	**Min**	**Max**
Directors as main predictors and moderators					
PD participation in the last year	279	2.45	1.90	0.00	6.00
Perceived management challenges	278	1.70	0.83	1.00	3.00
Directors' workload related to teachers	279	2.74	1.29	1.00	4.00
Years of experience	279	9.44	8.94	0.00	30.00
Directors' educational background					
Highest degree					
Less than BA degree	53 (19%)				
BA degree	122 (40.4%)				
Higher than BA degree	104 (37.3%)				
Field of highest degree is ECE/CD	140 (52.8%)				
Center-level control variable (for all questions)					
Number of lead teachers in the center	273	4.75	4.39	1.00	15.00

Following the descriptive statistics for all variables, fully unconditional (i.e., one-way random effects ANOVA) models for each outcome variable were used to assess the variability of CLASS scores across the centers. The results of these one-way random effects ANOVA models

provided the values to compute the intraclass correlation (ICC), which is the proportion of variance for the outcome variable within center-level (i.e., cluster effect). Using the formula ($ICC = \frac{\tau_{00}}{\tau_{00}+\sigma^2}$), ICC was computed for each CLASS domain as separate outcome variables (Huang, 2018; Raudenbush & Byrk, 2002, p. 36). ICCs for each of the three CLASS domains indicated dependency (ICC_{IS} = .66; ICC_{ES} = .44; CC_{CO} = .45), and remaining analyses were conducted with multi-level mixed models for each research question (see Appendix-B for ANOVA results). It is also important to note that according to ICCs, Instructional Support indicated the highest variability at the center level despite having the lowest mean score.

Following the null models, multi-level mixed models were tested for each research question and outcome variable. Before interpreting the result, HLM assumptions were taken into consideration, and homogeneity of level-1 variances tested, and the test results for each model indicated homogeneity (p-value>.500). Next, the residual distributions for each model at level-1 were checked whether the models violate normality and independency assumption for the residuals. Although the level-1 variances were homogenous, the histograms and Q-Q plots of residual terms indicated non-normal distributions and violated the normality assumption of HLM (see Appendix C) (Raudenbush & Byrk, 2002, pg. 255-256). Based on these tests, the final estimates and robust estimates for the fixed effects were compared. Parallel to the violations, the final estimates were not parallel. Therefore, robust results were used for the final interpretations.

Results Related to Control Variables

As mentioned in the methodology chapter, certain variables were controlled for in the statistical models. Before reporting the primary results, the findings regarding these selected control variables for each research question are listed below.

RQ1. For the RQ1, class-level control variables were defined as class size and child/adult ratio. Class size is significant control variable for all CLASS domains. According to the results, for every one unit increase in the class size, CLASS scores increased by .06 to .09 (Instructional Support: γ_{10}=.09, p=.05; Emotional Support: (γ_{10}=.06, p=.03; Classroom Organization: γ_{10}=.07, p=.02) after controlling for all the variables in the model. Child/Adult ratio, on the other hand, acted as a significant control variable for only Emotional Support domain; as the ratio increased by one unit, quality scores decreased by .11 (ES: γ_{20}=-.11, p=.05).

RQ2. For the RQ2, number of lead teachers was used as a control variable at the center-level. Results indicate that the number of lead teachers in the center predicted only the instructional support scores significantly; for one unit increase in the number of teachers, instructional support decreased by .03 (γ_{01}=-.03, p=.05).

RQ3. For the RQ3, only center-level control variable was the number of lead teachers in the center. Results from the analyses suggested that the variable was not consistently significant. In a few of the analyses, for Instructional Support scores and teachers' PD experiences, it was a significant control variable for the teachers who do not know whether they received T/TA. For every unit increase in the number of lead teachers, the association became weaker positive.

Some significant results were also noted for analyses conducted with Emotional Support scores. For every one unit increase in the number of lead teachers, the association between Emotional Support scores and PD hours on curriculum tended to be positive but weaker, but for intensity of mentoring, this association was negative and stronger. Parallel to these results, the number of lead teachers moderated the association between PD hours on curriculum and Classroom Organization scores in a similar way: positive but weaker association. Although the results were not consistent across the CLASS domains, having more teachers within the center

seemed to be positively associated with Emotional Support and Classroom Organization CLASS scores despite the decreased number of PD hours on curriculum.

Primary Results

The preliminary findings described above were used to guide the primary analyses. The primary results from multi-level mixed models are presented below, organized according to each set of research question, with results for each of the three CLASS domains.

Classroom/Teacher-level Predictors of Classroom Quality (RQ1a, 1b, & 1c)

The first research question examined teacher characteristics and in-service PD experiences as predictors of quality scores. These variables were teachers' highest degree, field of this degree, years of experience, and in-service PD experiences within the last 12 months, including PD hours in curriculum and assessment, intensity of mentor/coach visits, and T/TA participation. Class size and child/adult ratio were included as control variables in the models.

Results indicated that the fixed and random effects for the intercept of expected Instructional Support scores of teachers with BA and ECE/CD degrees who received T/TA in the last year were significant (γ_{00}=2.54, p<.001; u_{00}=.83, p<.001). However, classroom/teacher-level (i.e., level-1) variables were not significant predictors of Instructional Support quality (RQ1.a, see Table 6).

Table 6. Final Robust Estimation of Fixed Effects for Instructional Support

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	2.545806	0.075528	33.707	174	<0.001*
Number of lead teachers in the center, γ_{01}	-0.033363	0.016736	-1.994	174	0.048
Directors' years of experience, γ_{02}	-0.006439	0.008114	-0.794	174	0.429
PD activities in the last year, γ_{03}	0.002986	0.040708	0.073	174	0.942
Perceived management challenges, γ_{04}	-0.239105	0.149810	-1.596	174	0.112
Directors' highest degree is less than BA, γ_{05}	-0.207305	0.187854	-1.104	174	0.271
Directors' workload related to teachers, γ_{06}	-0.058079	0.110265	-0.527	174	0.599
Directors' field of highest degree is not ECE/CD, γ_{07}	-0.062675	0.136093	-0.461	174	0.646
Directors' highest degree is higher than BA, γ_{08}	0.042231	0.146745	0.288	174	0.774
For Classroom size slope, β_1					
INTRCPT2, γ_{10}	0.098241	0.048583	2.022	67	0.047*
For Child/Adult Ratio slope, β_2					
INTRCPT2, γ_{20}	-0.099159	0.081793	-1.212	67	0.230
For PD hours in curriculum in the last year slope, β_3					
INTRCPT2, γ_{30}	0.005183	0.005731	0.904	67	0.369
For PD hours in assessment in the last year slope, β_4					
INTRCPT2, γ_{40}	-0.008960	0.011735	-0.764	67	0.448
For Teachers' years of experience slope, β_5					
INTRCPT2, γ_{50}	0.005402	0.009215	0.586	67	0.560
For Intensity of mentoring/coaching slope, β_6					
INTRCPT2, γ_{60}	0.009782	0.050943	0.192	67	0.848
For Did not receive T/TA in the last year slope, β_7					
INTRCPT2, γ_{70}	0.165943	0.237141	0.700	67	0.486
For Do not know whether received T/TA in the last year slope, β_8					
INTRCPT2, γ_{80}	0.007917	0.341659	0.023	67	0.982
For Teachers' highest degree is less than BA slope, β_9					
INTRCPT2, γ_{90}	0.021905	0.191619	0.114	67	0.909
For Teachers' highest degree is higher than BA slope, β_{10}					
INTRCPT2, γ_{100}	-0.079662	0.266016	-0.299	67	0.766
For Teachers' field of highest degree is not ECE/CD slope, β_{11}					
INTRCPT2, γ_{110}	-0.004703	0.136344	-0.034	67	0.973
Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.83891	0.70376	174	4619.93441	<0.001*
level-1, r	0.20593	0.04241			

As for CLASS Emotional Support (RQ1.b), the fixed and random effects for the intercept of the same reference groups of teachers (i.e., with BA and ECE/CD degree who received T/TA in the last year) were significant (γ_{00}=5.44, p<.001; u_0=.48, p<.001). Furthermore, teachers'

highest degree was a significant predictor of Emotional Support scores. When teachers had higher than a BA degree, the Emotional Support scores tended to decrease by .29 after controlling for all the variables in the model compared to the teachers with BA degrees or less (γ_{100}=-.29, p = .001) (see Table 7).

Table 7. Final Robust Estimation of Fixed Effects for Emotional Support

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00*}	5.449915	0.044402	122.741	174	<0.001
Number of lead teachers in the center, γ_{01}	-0.014053	0.008894	-1.580	174	0.116
Directors' years of experience, γ_{02}	-0.002634	0.004563	-0.577	174	0.564
PD activities in the last year, γ_{03}	-0.006837	0.025044	-0.273	174	0.785
Perceived management challenges, γ_{04}	0.016355	0.081027	0.202	174	0.840
Directors' highest degree is less than BA, γ_{05}	-0.037691	0.111623	-0.338	174	0.736
Directors' workload related to teachers, γ_{06}	0.018612	0.058104	0.320	174	0.749
Directors' field of highest degree is not ECE/CD, γ_{07}	0.012989	0.080279	0.162	174	0.872
Directors' highest degree is higher than BA, γ_{08}	-0.000772	0.084348	-0.009	174	0.993
For Classroom size slope, β_1					
INTRCPT2, γ_{10*}	0.059520	0.025939	2.295	67	0.025
For Child/Adult Ratio slope, β_2					
INTRCPT2, γ_{20*}	-0.109691	0.054132	-2.026	67	0.047
For PD hours in curriculum in the last year slope, β_3					
INTRCPT2, γ_{30}	0.007877	0.006315	1.247	67	0.217
For PD hours in assessment in the last year slope, β_4					
INTRCPT2, γ_{40}	-0.014303	0.007728	-1.851	67	0.069
For Teachers' years of experience slope, β_5					
INTRCPT2, γ_{50}	-0.010785	0.009145	-1.179	67	0.242
For Intensity of mentoring/coaching slope, β_6					
INTRCPT2, γ_{60}	-0.055486	0.038069	-1.457	67	0.150
For Did not receive T/TA in the last year slope, β_7					
INTRCPT2, γ_{70}	-0.083314	0.159974	-0.521	67	0.604
For Do not know whether received T/TA in the last year slope, β_8					
INTRCPT2, γ_{80}	0.064437	0.177240	0.364	67	0.717
For Teachers' highest degree is less than BA slope, β_9					
INTRCPT2, γ_{90}	-0.128131	0.124233	-1.031	67	0.306
For Teachers' highest degree is higher than BA slope, β_{10}					
INTRCPT2, γ_{100*}	-0.292833	0.087403	-3.350	67	0.001
For Teachers' field of highest degree is not ECE/CD slope, β_{11}					
INTRCPT2, γ_{110}	0.099064	0.076057	1.302	67	0.197
Random Effect	**Standard Deviation**	**Variance Component**	***d.f.***	**χ^2**	***p*-value**
INTRCPT1, u_{0*}	0.48651	0.23669	174	3081.20306	<0.001
level-1, r	0.14663	0.02150			

Lastly, the fixed and random effects for the intercept for expected Classroom Organization (RQ1.c) scores for teachers with BA and ECE/CD degree who received T/TA in the last year were significant (γ_{00}=4.75, p<.001; u_0=.68, p<.001). In addition, the intensity of mentoring/coaching and highest degree were significant predictors of the Classroom Organization. As for intensity of mentoring/coaching, as the intensity increased, Classroom Organization scores tended to decrease by .09 (γ_{60}=.09, p=.017); when teachers had graduate education experiences compared to the teachers with BA and less degrees, there was a decrease in Classroom Organization scores by around .5 (γ_{100}=-.51, p<.001), after controlling for all the variables in the model (see Table 8).

Table 8. Final Robust Estimation of Fixed Effects for Classroom Organization

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00*}	4.751017	0.060415	78.639	174	<0.001
Number of lead teachers in the center, γ_{01}	-0.021400	0.012837	-1.667	174	0.097
Directors' years of experience, γ_{02}	-0.007635	0.006773	-1.127	174	0.261
PD activities in the last year, γ_{03}	-0.024937	0.035664	-0.699	174	0.485
Perceived management challenges, γ_{04}	-0.069694	0.122937	-0.567	174	0.572
Directors' highest degree is less than BA, γ_{05}	0.019236	0.159625	0.121	174	0.904
Directors' workload related to teachers, γ_{06}	0.031174	0.076129	0.409	174	0.683
Directors' field of highest degree is not ECE/CD, γ_{07}	0.035712	0.108657	0.329	174	0.743
Directors' highest degree is higher than BA, γ_{08}	0.051082	0.116712	0.438	174	0.662
For Classroom size slope, β_1					
INTRCPT2, γ_{10*}	0.074053	0.029856	2.480	67	0.016
For Child/Adult Ratio slope, β_2					
INTRCPT2, γ_{20}	-0.112068	0.063521	-1.764	67	0.082
For PD hours in curriculum in the last year slope, β_3					
INTRCPT2, γ_{30}	0.010114	0.008443	1.198	67	0.235
For PD hours in assessment in the last year slope, β_4					
INTRCPT2, γ_{40}	-0.012521	0.013024	-0.961	67	0.340
For Teachers' years of experience slope, β_5					
INTRCPT2, γ_{50}	-0.006869	0.010680	-0.643	67	0.522
For Intensity of mentoring/coaching slope, β_6					
INTRCPT2, γ_{60*}	-0.097532	0.039852	-2.447	67	0.017
For Did not receive T/TA in the last year slope, β_7					
INTRCPT2, γ_{70}	-0.070783	0.202050	-0.350	67	0.727
For Do not know whether received T/TA in the last year slope, β_8					
INTRCPT2, γ_{80}	0.033412	0.195089	0.171	67	0.865
For Teachers' highest degree is less than BA slope, β_9					
INTRCPT2, γ_{90}	-0.024445	0.198979	-0.123	67	0.903
For Teachers' highest degree is higher than BA slope, β_{10}					
INTRCPT2, γ_{100*}	-0.511331	0.134788	-3.794	67	<0.001
For Teachers' field of highest degree is not ECE/CD slope, β_{11}					
INTRCPT2, γ_{110}	-0.140186	0.101210	-1.385	67	0.171
Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.68525	0.46957	174	3659.034	<0.001
level-1, r	0.18535	0.03436			

Center/Director-level Predictors of Classroom Quality (RQ2a, 2b, & 2c)

The second research question examined director characteristics and experiences as predictors of quality scores. For this step, directors' highest degree, field of this degree, years of experience, PD experiences in the last 12 months, perceived management challenges, and teacher

related workload were included in the models. For level-2, number of lead teachers was the only control variable.

Results indicated that for directors with BA and ECE/CD degrees as reference groups, the fixed and random effects for expected Instructional Support scores (RQ2.a) were significant (γ_{00}=2.54, p<.001; u_{00}=.83, p<.001); as for the expected CLASS Emotional Support scores (RQ2.b), the fixed and random effects for the intercept of the same reference group were significant (γ_{00}=5.44, p<.001; u_0=.48, p<.001); lastly, the fixed and random effects for the intercept of expected Classroom Organization scores (RQ2.c) were significant (γ_{00}=4.75, p<.001; u_0=.68, p<.001). However, in all three domains, the director related independent variables were not significant main predictors of CLASS scores (see Table 6, 7, & 8).

Cross-level Interactions: Directors as Moderators (RQ3a, 3b, &3c)

Analyses were conducted to examine the interactions among director characteristics and teachers' in-service PD experiences as predictors of classroom quality and the results indicated significant associations (RQ3). For testing cross-level interactions, teachers' in-service PD experiences within the last year and director-level moderators were included to see the changes in the CLASS scores. Teachers' in-service PD experiences within the last year consisted of PD hours in curriculum and assessment, intensity of the mentor visits, and T/TA participation. Moderator variables were directors' educational background (highest degree, field), years of experience, PD participation within the last year, management challenges, and teacher-related workload. Since each CLASS domain is represented in independent sub research questions, the results from these interactions are reported accordingly (see also Table-9 for summary results).

Table 9. Summary table for cross-level interactions (RQ3)

Moderator	Instructional Support (See Table 10 for details)						Emotional Support (See Table 11 for details)						Classroom Organization (See Table 12 for details)					
	Director's highest degree	Director's field of degree	Director's years of experience	Director's PD participation	Director's workload related to teachers	Director's management challenges	Director's highest degree	Director's field of degree	Director's years of experience	Director's PD participation	Director's workload related to teachers	Director's management challenges	Director's highest degree	Director's field of degree	Director's years of experience	Director's PD participation	Director's workload related to teachers	Director's management challenges
Teacher's PD hours on curriculum	✓ (γ_{18}=-.06, p = .04)	✓ (γ_{17}=.05, p = .04)				✓ (γ_{14}=-.04, p = .05)	✓ (γ_{18}=-.04, p = .003)				✓ (γ_{16}=-.05, p = .03)		✓ (γ_{18}=.079, p< .001)				✓ (γ_{16}=-.06, p = .015)	
Teacher's PD hours on assessment	✓ (γ_{25}=.07, p = .05; γ_{28}=.07, p = .006)				✓ (γ_{26}=-.05 p = .02)	✓ (γ_{24}=.05, p = .01)											✓ (γ_{26}=.06, p=.02)	
Intensity of mentoring	✓ (γ_{35}=.57, p < .001)		✓ (γ_{35}=.57, p < .001)					✓ (γ_{37}=.20, p = .005)						✓ (γ_{37}=.32, p=.003)			✓ (γ_{36}=-.16, p=.035)	
Teacher's T/TA participation	✓ (γ_{42}=-.07, p = .05)	✓ (γ_{45}=2.31, p < .001)	✓ (γ_{47}=1.55, p<.001; γ_{52}=-.06, p = .05)	✓ (γ_{43}=.37, p = .04)	✓ (γ_{46}=-.79, p = .02)	✓ (γ_{54}=.88, p = .006)		✓ (γ_{47}=1.39, p < .001; γ_{57}=1.41, p < .001)	✓ (γ_{42}=-.12, p = .001; γ_{52}=-.08, p = .017)					✓ (γ_{47}=1.72, p=.006; γ_{57}=1.70, p=.005)	✓ (γ_{42}=-0.15, p=.003; γ_{52}=-.11, p=.02)			

Instructional Support (RQ3a)

The association between the teachers' hours of PD on curriculum and Instructional Support scores was moderated by directors' highest degree and perceived management challenges. When the directors had higher than BA degrees the negative association got stronger, and when the directors' degree was not from ECE/CD field, this relationship took a stronger positive direction. Further, there was a stronger negative relationship between the teachers' PD hours on curriculum and the CLASS Instructional Support scores for the directors who felt more challenged in management (γ_{14}=-.04, p = .05) (see Table 9 & 10).

The association between the teachers' PD hours on assessment and Instructional Support scores was moderated by the directors' perceived management challenges, workload related to teachers, and the directors' educational background. the associations tended to be stronger positive relationship as the directors reported feeling more challenged (γ_{24}=.05, p = .01), and they had a degree other than BA (i.e., either less or higher than BA) (γ_{25}=.07, p = .05; γ_{28}=.07, p = .006). The direction of the relationship changed from positive to negative for the directors with increased teacher-related workload (γ_{26}=-.05 p = .02).

As for the association between intensity of mentoring/coaching that teachers receive (PD) and Instructional Support scores was moderated by the directors' years of experience and educational background (highest degree). There was a stronger positive association for the directors had less than BA degree (γ_{35}=.57, p < .001), and the association was negative but weaker as the directors had more years of experience (γ_{32}=-.01, p = .041).

Another variable related to teachers' PD experiences was the T/TA participation. For this component, directors' years of experience, educational background, PD activities in the last year, teacher-related workload, and management challenges were significant moderators of the

association between the teachers' participation in T/TA in the last year and Instructional Support scores. For the teachers who did not receive T/TA, there was a stronger positive relationship when the directors had a degree less than BA (γ_{45}=2.31, p < .001) and other than ECE/CD fields (γ_{47}=1.55, p<.001). The direction of the relationship changed from positive to negative, and it became stronger for the directors who had a more intense teacher-related workload (γ_{46}=-.79, p = .02). Lastly, the relationship became weaker for every one year increase in directors' experience (γ_{42}=-.07, p = .05) and every one unit increase in PD activities in the last year (γ_{43}=.37, p = .04).

Since T/TA participation consisted of two dummy variables (i.e., did not receive; do not know whether received), the associations between teachers who were not sure whether they received T/TA and Instructional Support scores became weaker as the directors' years of experience increased (γ_{52}=-.06, p = .05), and every one unit increase in perceived management challenges made the relationship positive and stronger (γ_{54}=.88, p = .006).

Table 10. Mixed Moderation Model with Robust Final Estimations for Instructional Support

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00*}	2.523856	0.070273	35.915	183	<0.001
Number of lead teachers in the center, γ_{01}	-0.031387	0.015989	-1.963	183	0.051
Directors' years of experience, γ_{02}	-0.006584	0.007438	-0.885	183	0.377
PD activities in the last year, γ_{03}	-0.001243	0.037141	-0.033	183	0.973
Perceived management challenges, γ_{04}	-0.209747	0.136951	-1.532	183	0.127
Directors' highest degree is less than BA, γ_{05}	-0.135571	0.181082	-0.749	183	0.455
Directors' workload related to teachers, γ_{06}	-0.059250	0.103346	-0.573	183	0.567
Directors' field of highest degree is not ECE/CD, γ_{07}	-0.055589	0.127696	-0.435	183	0.664
Directors' highest degree is higher than BA, γ_{08}	-0.001236	0.136856	-0.009	183	0.993
For PD hours in curriculum in the last year slope, β_1					
INTRCPT2, γ_{10}	-0.000035	0.007155	-0.005	56	0.996
Number of lead teachers in the center, γ_{11}	0.002063	0.001276	1.616	56	0.112
Directors' years of experience, γ_{12}	0.001677	0.001024	1.638	56	0.107
PD activities in the last year, γ_{13}	-0.019698	0.010260	-1.920	56	0.060
Perceived management challenges, γ_{14*}	-0.040902	0.020000	-2.045	56	0.046
Directors' highest degree is less than BA, γ_{15}	0.017978	0.018151	0.990	56	0.326
Directors' workload related to teachers, γ_{16}	0.040529	0.021147	1.917	56	0.060
Directors' field of highest degree is not ECE/CD, γ_{17*}	0.049427	0.023549	2.099	56	0.040

Directors' highest degree is higher than BA, γ_{18*}	-0.062138	0.029911	-2.077	56	0.042
For PD hours in assessment in the last year slope, β_2					
INTRCPT2, γ_{20}	0.022182	0.012735	1.742	56	0.087
Number of lead teachers in the center, γ_{21}	0.001767	0.002975	0.594	56	0.555
Directors' years of experience, γ_{22}	-0.001753	0.001250	-1.402	56	0.166
PD activities in the last year, γ_{23}	-0.005197	0.010853	-0.479	56	0.634
Perceived management challenges, γ_{24*}	0.052509	0.021529	2.439	56	0.018
Directors' highest degree is less than BA, γ_{25*}	0.076229	0.037816	2.016	56	0.049
Directors' workload related to teachers, γ_{26*}	-0.052045	0.021962	-2.370	56	0.021
Directors' field of highest degree is not ECE/CD, γ_{27}	0.008631	0.025800	0.335	56	0.739
Directors' highest degree is higher than BA, γ_{28*}	0.070774	0.025013	2.829	56	0.006
For Intensity of mentoring/coaching slope, β_3					
INTRCPT2, γ_{30}	0.229041	0.055406	4.134	56	<0.001
Number of lead teachers in the center, γ_{31}	-0.011301	0.013490	-0.838	56	0.406
Directors' years of experience, γ_{32*}	-0.010993	0.005243	-2.097	56	0.041
PD activities in the last year, γ_{33}	-0.010746	0.038590	-0.278	56	0.782
Perceived management challenges, γ_{34}	-0.139446	0.164079	-0.850	56	0.399
Directors' highest degree is less than BA, γ_{35*}	0.570896	0.154727	3.690	56	<0.001
Directors' workload related to teachers, γ_{36}	0.002494	0.088162	0.028	56	0.978
Directors' field of highest degree is not ECE/CD, γ_{37}	0.114214	0.115645	0.988	56	0.328
Directors' highest degree is higher than BA, γ_{38}	-0.087109	0.110154	-0.791	56	0.432
For Did not receive T/TA in the last year slope, β_4					
INTRCPT2, γ_{40}	0.373784	0.201865	1.852	56	0.069
Number of lead teachers in the center, γ_{41}	0.004189	0.036461	0.115	56	0.909
Directors' years of experience, γ_{42*}	-0.076004	0.038038	-1.998	56	0.051
PD activities in the last year, γ_{43*}	0.373526	0.174843	2.136	56	0.037
Perceived management challenges, γ_{44}	-0.136089	0.393591	-0.346	56	0.731
Directors' highest degree is less than BA, γ_{45*}	2.314322	0.459074	5.041	56	<0.001
Directors' workload related to teachers, γ_{46*}	-0.792040	0.321529	-2.463	56	0.017
Directors' field of highest degree is not ECE/CD, γ_{47*}	1.550740	0.438120	3.540	56	<0.001
Directors' highest degree is higher than BA, γ_{48}	0.711858	0.518170	1.374	56	0.175
For Do not know whether received T/TA in the last year slope, β_5					
INTRCPT2, γ_{50}	-0.680196	0.264340	-2.573	56	0.013
Number of lead teachers in the center, γ_{51*}	0.090875	0.032061	2.834	56	0.006
Directors' years of experience, γ_{52*}	-0.063526	0.032426	-1.959	56	0.055
PD activities in the last year, γ_{53}	-0.251355	0.162591	-1.546	56	0.128
Perceived management challenges, γ_{54*}	0.886625	0.310313	2.857	56	0.006
Directors' highest degree is less than BA, γ_{55}	1.013121	0.542881	1.866	56	0.067
Directors' workload related to teachers, γ_{56}	-0.392154	0.314447	-1.247	56	0.218
Directors' field of highest degree is not ECE/CD, γ_{57}	0.688972	0.377630	1.824	56	0.073
Directors' highest degree is higher than BA, γ_{58}	0.704635	0.415664	1.695	56	0.096

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_{0*}	0.79752	0.63604	183	7818.87787	<0.001
level-1, r	0.16225	0.02632			

Overall, the results for Instructional Support scores revealed the moderation effects of center directors' characteristics (see Table 9 & 10). Directors' educational background, years of experience, management challenges, and workload related to teachers seemed to play important

roles as moderators when we consider teachers' professional development experiences as the predictors of CLASS Instructional Support.

Emotional Support (RQ3b)

With respect to the interactions among directors' characteristics, teachers' in-service PD experiences, and CLASS Emotional Support scores, the results indicated significant associations (RQ3.b, see Table 9 & 11). The association between the teachers' PD hours on curriculum and Emotional Support scores was moderated by the directors' educational background and workload related to teachers. As the directors experienced increased workload related to teachers (γ_{16}=-.05, p = .03) and hold a degree higher than BA (γ_{18}=-.04, p = .003), the association tended to become negative and stronger.

Intensity of mentoring/coaching is another aspect of in-service PD experience for teachers; the association between this PD component and the Emotional Support scores was moderated by the directors' educational background. There was stronger positive association for the director holding a degree from a field other than an ECE/CD related field (γ_{37}=.20, p = .005).

Lastly, the relationship between teachers' T/TA participation and Emotional Support was moderated by the directors' years of experience, and their educational background. For directors who did not have an ECE/CD degree, the positive association was stronger (γ_{47}=1.39, p < .001; γ_{57}=1.41, p < .001). In other words, when directors did not have ECE/CD degrees, teachers' lack of T/TA support was a stronger positive predictor of Emotional Support scores. On the other hand, for directors' years of experience, this association was negative; for the teachers who did not receive TA, the association is negative and stronger (γ_{42}=-.12, p = .001), and for the ones who reported they did not know whether they received T/TA, the association between T/TA participation and Emotional Support was negative and weaker (γ_{52}=-.08, p = .017).

Overall, the directors' educational background, years of experience, and workload functioned as significant moderators when teachers' in-service PD activities were examined as predictors of CLASS Emotional Support scores.

Table 11. Mixed Model (Moderation) with Robust Final Estimations for Emotional Support

Fixed Effect	Coefficient	SE	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00*}	5.451314	0.042425	128.493	183	<0.001
Number of lead teachers in the center, γ_{01}	-0.013783	0.008611	-1.601	183	0.111
Directors' years of experience, γ_{02}	-0.004398	0.004472	-0.983	183	0.327
PD activities in the last year, γ_{03}	-0.000854	0.023766	-0.036	183	0.971
Perceived management challenges, γ_{04}	-0.007074	0.077163	-0.092	183	0.927
Directors' highest degree is less than BA, γ_{05}	-0.088114	0.106716	-0.826	183	0.410
Directors' workload related to teachers, γ_{06}	0.036936	0.056070	0.659	183	0.511
Directors' field of highest degree is not ECE/CD, γ_{07}	-0.019472	0.076998	-0.253	183	0.801
Directors' highest degree is higher than BA, γ_{08}	-0.063851	0.079529	-0.803	183	0.423
For PD hours in curriculum in the last year slope, β_1					
INTRCPT2, γ_{10}	0.008155	0.006762	1.206	56	0.233
Number of lead teachers in the center, γ_{11*}	0.006974	0.001922	3.629	56	<0.001
Directors' years of experience, γ_{12}	-0.000063	0.000947	-0.066	56	0.948
PD activities in the last year, γ_{13}	0.003710	0.007046	0.527	56	0.601
Perceived management challenges, γ_{14}	0.019950	0.026920	0.741	56	0.462
Directors' highest degree is less than BA, γ_{15}	0.018822	0.018741	1.004	56	0.320
Directors' workload related to teachers, γ_{16*}	-0.059601	0.026707	-2.232	56	0.030
Directors' field of highest degree is not ECE/CD, γ_{17}	0.003737	0.020446	0.183	56	0.856
Directors' highest degree is higher than BA, γ_{18*}	-0.043582	0.013905	-3.134	56	0.003
For PD hours in assessment in the last year slope, β_2					
INTRCPT2, γ_{20}	-0.007327	0.010703	-0.685	56	0.496
Number of lead teachers in the center, γ_{21}	-0.004437	0.003210	-1.382	56	0.172
Directors' years of experience, γ_{22}	-0.001468	0.001012	-1.451	56	0.152
PD activities in the last year, γ_{23}	-0.009006	0.008363	-1.077	56	0.286
Perceived management challenges, γ_{24}	-0.023199	0.020303	-1.143	56	0.258
Directors' highest degree is less than BA, γ_{25}	-0.009782	0.041184	-0.238	56	0.813
Directors' workload related to teachers, γ_{26}	0.033369	0.025630	1.302	56	0.198
Directors' field of highest degree is not ECE/CD, γ_{27}	-0.004058	0.023936	-0.170	56	0.866
Directors' highest degree is higher than BA, γ_{28}	-0.012742	0.019096	-0.667	56	0.507
For Intensity of mentoring/coaching slope, β_3					
INTRCPT2, γ_{30}	0.012753	0.040865	0.312	56	0.756
Number of lead teachers in the center, γ_{31*}	-0.026758	0.011320	-2.364	56	0.022
Directors' years of experience, γ_{32}	-0.007281	0.004578	-1.591	56	0.117
PD activities in the last year, γ_{33}	0.015050	0.027833	0.541	56	0.591
Perceived management challenges, γ_{34}	-0.195300	0.121714	-1.605	56	0.114
Directors' highest degree is less than BA, γ_{35}	0.094161	0.111869	0.842	56	0.404
Directors' workload related to teachers, γ_{36}	-0.049793	0.059553	-0.836	56	0.407
Directors' field of highest degree is not ECE/CD, γ_{37*}	0.200620	0.069270	2.896	56	0.005
Directors' highest degree is higher than BA, γ_{38}	0.011463	0.076942	0.149	56	0.882

For Did not receive T/TA in the last year slope, β_4					
INTRCPT2, γ_{40}	0.080704	0.174314	0.463	56	0.645
Number of lead teachers in the center, γ_{41}	0.005543	0.032447	0.171	56	0.865
Directors' years of experience, γ_{42*}	-0.121190	0.035180	-3.445	56	0.001
PD activities in the last year, γ_{43}	0.087841	0.148219	0.593	56	0.556
Perceived management challenges, γ_{44}	-0.166974	0.360548	-0.463	56	0.645
Directors' highest degree is less than BA, γ_{45}	0.651862	0.463065	1.408	56	0.165
Directors' workload related to teachers, γ_{46}	0.181164	0.247545	0.732	56	0.467
Directors' field of highest degree is not ECE/CD, γ_{47*}	1.394971	0.399294	3.494	56	<0.001
Directors' highest degree is higher than BA, γ_{48}	-0.518668	0.400575	-1.295	56	0.201
For Do not know whether received T/TA in the last year slope, β_5					
INTRCPT2, γ_{50}	0.084815	0.222455	0.381	56	0.704
Number of lead teachers in the center, γ_{51}	-0.005632	0.036878	-0.153	56	0.879
Directors' years of experience, γ_{52*}	-0.084090	0.034205	-2.458	56	0.017
PD activities in the last year, γ_{53}	-0.008158	0.137956	-0.059	56	0.953
Perceived management challenges, γ_{54}	-0.101110	0.319728	-0.316	56	0.753
Directors' highest degree is less than BA, γ_{55}	0.756700	0.566249	1.336	56	0.187
Directors' workload related to teachers, γ_{56}	0.027435	0.231031	0.119	56	0.906
Directors' field of highest degree is not ECE/CD, γ_{57*}	1.412550	0.364344	3.877	56	<0.001
Directors' highest degree is higher than BA, γ_{58}	-0.223085	0.381016	-0.586	56	0.561

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_{0*}	0.47723	0.22775	183	4007.59060	<0.001
level-1, *r*	0.13240	0.01753			

Classroom Organization (RQ3c)

Finally, analyses were conducted to test cross-level interactions for the CLASS Classroom Organization domain scores (RQ3.c, see Table 9&12). The association between teachers' hours of training on curriculum and the Classroom Organization scores was moderated by directors' highest degree and teacher related workload. There was a stronger negative association when the directors had higher than BA degree (γ_{18}=-*.079, p< .001)*, and more workload related to teachers (γ_{16}=-*.06, p = .015)*. Regarding the association between teachers' PD hours on assessment and Classroom Organization scores, the directors'' workload related to teachers acted as a significant moderator (γ_{26}=*.06, p=.02).* As the directors'' workload increased, the association was positive and stronger.

As for the association between the intensity of mentoring/coaching that teachers experience and Classroom Organization scores, the directors' educational background and teacher-related workload were significant moderators. When the director did not have a degree in ECE/CD fields, this association was positive and stronger (γ_{37}=*.32, p=.003),* and the increased workload made this association negative but stronger (γ_{36}=*-.16, p=.035).*

Lastly, the relationship between teachers' T/TA participation (i.e., both for the ones who did not receive and do not know whether they received T/TA) and Classroom Organization was moderated by the directors' years of experience and educational background. When the director did not hold an ECE/CD degree, the associations were positive and strong (γ_{47}=1.72, p=.006; γ_{57}=1.70, p=.005), but as the directors' years of experience increased, the association between T/TA participation and Classroom Organization became negative and weaker (γ_{42}=-0.15, p=.003; γ_{52}=-.11, p=.02). Overall, similar to the other domains, center directors' educational background, years of experience, and workload related to teachers were significant moderators for the associations between teachers' in-service PD experiences and Classroom Organization scores.

Table 12. Mixed Model (Moderation) with Robust Final Estimations for Classroom Organization

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	4.755902	0.055893	85.089	183	<0.001
Number of lead teachers in the center, γ_{01}	-0.022684	0.012260	-1.850	183	0.066
Directors' years of experience, γ_{02}	-0.009332	0.006461	-1.444	183	0.150
PD activities in the last year, γ_{03}	-0.015310	0.032829	-0.466	183	0.642
Perceived management challenges, γ_{04}	-0.053561	0.112733	-0.475	183	0.635
Directors' highest degree is less than BA, γ_{05}	-0.050932	0.149375	-0.341	183	0.734
Directors' workload related to teachers, γ_{06}	0.041555	0.073392	0.566	183	0.572
Directors' field of highest degree is not ECE/CD, γ_{07}	-0.009312	0.101704	-0.092	183	0.927
Directors' highest degree is higher than BA, γ_{08}	-0.029497	0.107651	-0.274	183	0.784
For PD hours in curriculum in the last year slope, β_1					
INTRCPT2, γ_{10}	0.007922	0.009292	0.853	56	0.398
Number of lead teachers in the center, γ_{11*}	0.006930	0.002423	2.860	56	0.006
Directors' years of experience, γ_{12}	0.001409	0.001194	1.180	56	0.243

PD activities in the last year, γ_{13}	-0.000909	0.006043	-0.150	56	0.881
Perceived management challenges, γ_{14}	0.013885	0.026769	0.519	56	0.606
Directors' highest degree is less than BA, γ_{15}	0.018815	0.019611	0.959	56	0.341
Directors' workload related to teachers, γ_{16*}	-0.060922	0.024247	-2.513	56	0.015
Directors' field of highest degree is not ECE/CD, γ_{17}	0.019477	0.018740	1.039	56	0.303
Directors' highest degree is higher than BA, γ_{18*}	-0.079970	0.019991	-4.000	56	<0.001
For PD hours in assessment in the last year slope, β_2					
INTRCPT2, γ_{20}	-0.010390	0.013340	-0.779	56	0.439
Number of lead teachers in the center, γ_{21}	-0.007616	0.004264	-1.786	56	0.080
Directors' years of experience, γ_{22}	-0.002694	0.001403	-1.920	56	0.060
PD activities in the last year, γ_{23}	-0.007202	0.010170	-0.708	56	0.482
Perceived management challenges, γ_{24}	-0.022523	0.018564	-1.213	56	0.230
Directors' highest degree is less than BA, γ_{25}	0.004951	0.041932	0.118	56	0.906
Directors' workload related to teachers, γ_{26*}	0.060235	0.024616	2.447	56	0.018
Directors' field of highest degree is not ECE/CD, γ_{27}	-0.001962	0.021829	-0.090	56	0.929
Directors' highest degree is higher than BA, γ_{28}	-0.033980	0.023867	-1.424	56	0.160
For Intensity of mentoring/coaching slope, β_3					
INTRCPT2, γ_{30}	0.061995	0.056239	1.102	56	0.275
Number of lead teachers in the center, γ_{31}	-0.013340	0.014251	-0.936	56	0.353
Directors' years of experience, γ_{32}	-0.010463	0.005715	-1.831	56	0.072
PD activities in the last year, γ_{33}	0.019509	0.042035	0.464	56	0.644
Perceived management challenges, γ_{34}	-0.194094	0.164158	-1.182	56	0.242
Directors' highest degree is less than BA, γ_{35}	0.212702	0.135405	1.571	56	0.122
Directors' workload related to teachers, γ_{36*}	-0.160260	0.074289	-2.157	56	0.035
Directors' field of highest degree is not ECE/CD, γ_{37*}	0.328899	0.106906	3.077	56	0.003
Directors' highest degree is higher than BA, γ_{38}	-0.046380	0.087879	-0.528	56	0.600
For Did not receive T/TA in the last year slope, β_4					
INTRCPT2, γ_{40}	0.223041	0.231883	0.962	56	0.340
Number of lead teachers in the center, γ_{41}	0.005999	0.045051	0.133	56	0.895
Directors' years of experience, γ_{42*}	-0.152614	0.049960	-3.055	56	0.003
PD activities in the last year, γ_{43}	-0.032300	0.211672	-0.153	56	0.879
Perceived management challenges, γ_{44}	-0.585221	0.539478	-1.085	56	0.283
Directors' highest degree is less than BA, γ_{45}	0.927804	0.584688	1.587	56	0.118
Directors' workload related to teachers, γ_{46}	-0.055805	0.286321	-0.195	56	0.846
Directors' field of highest degree is not ECE/CD, γ_{47*}	1.725137	0.600569	2.873	56	0.006
Directors' highest degree is higher than BA, γ_{48}	-0.217071	0.488716	-0.444	56	0.659
For Do not know whether received T/TA in the last year slope, β_5					
INTRCPT2, γ_{50}	-0.165505	0.284962	-0.581	56	0.564
Number of lead teachers in the center, γ_{51}	0.019865	0.050278	0.395	56	0.694
Directors' years of experience, γ_{52*}	-0.112405	0.047809	-2.351	56	0.022
PD activities in the last year, γ_{53}	0.031579	0.189787	0.166	56	0.868
Perceived management challenges, γ_{54}	0.700434	0.396506	1.767	56	0.083
Directors' highest degree is less than BA, γ_{55}	0.687319	0.791354	0.869	56	0.389
Directors' workload related to teachers, γ_{56}	-0.585826	0.326670	-1.793	56	0.078
Directors' field of highest degree is not ECE/CD, γ_{57*}	1.703276	0.576124	2.956	56	0.005
Directors' highest degree is higher than BA, γ_{58}	0.401175	0.473768	0.847	56	0.401

Random Effect	sd	Variance component	d.f.	χ^2	*p*-value
INTRCPT1, u_{0*}	0.65406	0.42780	183	4076.63165	<0.001
level-1, r	0.17694	0.03131			

Summary of the Results

To conclude, although the results indicated limited associations between select characteristics of teachers and classroom quality as measured by the CLASS, director characteristics were significant moderators of the associations between teachers' in-service PD experiences and classroom quality. For directors who received degrees in ECE/CD fields and graduate-level, had more years of experience, and dedicated more of their workload to work with teachers, the associations between teachers' PD experiences and CLASS scores were more prone to be negative. In other words, although teachers did not report higher PD hours and activities, CLASS scores were still higher. On the other hand, these associations' directions were more positive for the directors who felt more challenged in their position and lacked BA or ECE/CD related degrees. Thus, in these cases, teachers' more structured in-service PD experiences were associated with higher CLASS scores. These results are discussed in detail in the next chapter.

CHAPTER VII: DISCUSSION AND IMPLICATIONS

Introduction

The results of the multi-level analysis of the FACES 2014 dataset indicated center directors' characteristics moderated associations between teachers' in-service PD experiences and classroom quality scores. These results highlighted important considerations related to the ECE workforce and implications to assure high quality practice in Head Start as well as overall ECE to improve quality. The three research questions of this study aimed to predict classroom quality according to teacher and center director characteristics using quality ratings from the three domains of the CLASS measure. Therefore, parallel to the results chapter, this discussion chapter is organized according to teacher-related predictors, director-related predictors, and the cross-level interactions regarding the ways that directors moderate the associations between teachers' in-service PD experiences and classroom quality. The discussion will address the current results in terms of connections to both the existing literature, theory, and implications for practice and policy. Following the discussion, this chapter concludes with strengths and limitations of this study and future research directions.

Teacher-related Predictors (RQ1a, 1b, 1c)

The first question examined whether teacher characteristics are main predictors of CLASS domain scores. These characteristics included teachers' educational background, years of experience, and in-service PD experiences within the last 12 months. Separate analyses were conducted for each of the CLASS domains, and results from each domain as related to teachers' characteristics are discussed below.

Instructional Support (RQ1a)

CLASS Instructional Support domain measures teacher-child interactions in terms of the ways that teachers facilitate the learning, including concept development, quality feedback, and language modeling (Hamre et al., 2009; Pianta et al., 2008). Several studies in the relevant literature indicate it is common for classrooms to receive the lowest mean scores, compared to other domains, for Instructional Support, especially prior to the interventions in experimental studies (Roehrig et al., 2011; Zan & Donegan-Ritter, 2014). Similarly, the results of the current study showed the lowest mean scores for Instructional Support ($Mean_{IS}$=2.44, sd=.85) compared to the other CLASS domains (see Table 5). This mean score is parallel not only to the existing literature but also the Head Start DRS competitive thresholds. The Head Start Monitoring System has set the lowest required threshold for Instructional Support, which is 2.5, compared to the thresholds (5.00) for the remaining two domains (ECLKC, n.d.). Furthermore, according to the results of the current study, although none of the teacher-related characteristics are significant predictors of Instructional Support quality, the intra-class correlation (ICC) for Instructional Support indicated the highest dependency at the center-level (.66). In light of these connections among the current results, existing literature, and ongoing standards, despite the lack of significant predictions, the CLASS Instructional Support domain in relation to teacher and contextual characteristics warrants more attention within the discussion of this study.

Although, CLASS is a holistic measure of the classroom interactions and each domain is equally essential, Instructional Support domain requires higher levels of cognitive effort between teachers and children reciprocally, in addition to teachers' professional knowledge and skills. For instance, in order to score high (6-7), teacher needs progressive interactions, including using

many open-ended questions, advanced language, and quality feedback to encourage children's involvement and progress in the activities. This type of progressive and rich instruction in the classroom is a function of not only teachers' instructional skills, but also children's background and developmental stages. Therefore, the performance in this domain depends on both teacher's and children's performance, and the low scores also implies the importance of contextual factors for predicting Instructional Support quality. Head Start serves vulnerable populations whose families are experiencing low-incomes or poverty. Within these adverse conditions, expecting equally higher cognitive skills and performance from children may not be an equitable approach (Clements et al., 2013; National Academies of Sciences, Engineering, and Medicine, 2019). Teachers may experience additional demands in the classroom and need to adjust their instruction according to their classroom context. Therefore, these adjustments may require instructional strategies that would be scored lower on the CLASS measure of Instructional Support. On the other hand, in the remaining two domains (i.e., Emotional Support and Classroom Organization), scores are largely dependent on the teachers' personal efforts and skills, and less impacted by children's responses. Overall, these lower scores could imply connections to the HSPPS and DRS regulations, and the speculations regarding the current findings imply that the quality monitoring policies set this threshold lower, perhaps with an equitable approach, considering the diverse Head Start population.

However, for supporting the vulnerable children population most effectively, teachers' professional knowledge and efforts are fundamentally important. Roehrig and colleagues (2011) emphasized the importance of culturally-relevant instruction in diverse settings and the need to provide PD and mentoring/coaching for ECE teachers to handle the challenges of working with vulnerable children. Similarly, an effective strategy in Head Start would be providing the

teachers with PD and mentoring/coaching activities to improve their skills to work within diverse classroom setting.

Furthermore, the current study tested whether certain teacher characteristics predict Instructional Support scores. These characteristics were teachers' educational background, years of experiences, and in-service PD experiences. With regard to the teachers' education and years of experience, the literature has quite mixed findings. There are several studies which do not indicate significant associations between teachers' education and overall classroom quality (Bulotsky-Shearer et al., 2012; Early et al., 2007; LoCasale-Crouch, 2007; Pianta et al., 2005). For instance, Pianta and colleagues (2014) conducted a year-long MyTeachingPartner (MTP) online coaching intervention on CLASS for ECE teachers. Although scores in each domain demonstrated significant growth, there was no significant association between the teachers' highest degree (i.e., years in education) or years of experience with Instructional Support. Another study by Bulotsky-Shearer and colleagues (2012), conducted a multilevel latent profile analysis with FACES 1997 data to see the classroom quality profiles. These profiles were analyzed according to parent home and school involvement, as well as classroom quality, which consisted of ECERS overall mean, Assessment Profile for Early Childhood Programs, Arnett Caregiver Interaction Scale, and classroom emotional climate. The latent profiles did not indicate any significant associations with teachers' education, experience, or number of annual PD activities. In contrast to these insignificant findings, there are also studies which indicated significant associations, showing that teachers' ECE degrees as significant predictors of higher classroom quality (Burchinal et al., 2002; Son et al., 2013). Even though not every study used CLASS to measure the quality, taken together, research examining the relationship between teacher related education and years of experience characteristics and both overall quality as well

as Instructional Support has produced mixed results. This study's results are consistent with the literature that has found no associations between teacher education and years of experience with scores on the CLASS Instructional Support domain.

Regarding teachers' in-service PD experiences, it is important to note that the nature of the current study does not unpack the intention, content, and quality of teachers' PD activities. Instead, it focuses on whether they participated in PD activities and the intensity (e.g., hours and frequency) of PD in which they were engaged, and these in-service PD engagements do not appear to be significant predictors of Instructional Support. Intensity is a debatable component of PD activities; although, it is often examined as a significant moderator for intervention effects, there is no unified definition for the ideal amount of in-service PD in the literature, and amount/intensity depends on each study's design and PD goals (Dunst, 2015; Egert et al., 2018). Relatedly, Pianta et al. (2014B) conducted an intervention study to test the ideal dosage of PD for the ECE teachers with MyTeachingPartner (MTP) which, as mentioned previously, is an online PD support system. The authors provided a 14-week-course for an intervention group of 205 ECE teachers that sought to improve their CLASS scores. MTP cycles focused on different CLASS domains and started in September and was implemented through May. Each coaching cycle consisted of teachers' self-recording of a literacy and language activity and coach's online feedback on this video-clip. These recording-feedback cycles occurred every two weeks and were repeated throughout the year; the first three cycles aimed Emotional Support, the next two were on Classroom organization, and the remaining was on Instructional Support (Pianta et al., 2014B, p. 502). After the intervention, results indicated the highest dosage of PD was associated with maximum growth in Instructional Support domain (around 13 cycles). Therefore, considering the lower mean score of Instructional Support across classrooms in the current

study's sample, the lack of association with education/experience and PD could be an indication that teachers need for more intensive in-service PD and mentoring/coaching to improve their Instructional Support scores. This speculation is consistent with the point noted earlier regarding the aforementioned DRS requirements for Instructional Support, as this domain has the lowest threshold in order to renew funding. This speculation also implies that despite the teachers' needs for higher PD dosage for observing higher scores, Head Start teachers may focus on other aspects of teaching in their PD activities for improving their performances in the remaining CLASS domains.

The current cross-sectional study asked participants retrospective questions regarding their PD experiences within the last 12 months; therefore, results from the current study cannot highlight change over time. The literature that has examined teachers' practices over time does include evidence of improvements in classroom quality, including CLASS Instructional Support domain, following intentional and structured PD interventions for ECE teachers. For instance, Roehrig and colleagues (2011) conducted a PD intervention on culturally-relevant science teaching for two years. After the intervention, teachers' Instructional Support scores increased significantly. The researchers concluded that in order to make a change in the instructional performance, it is essential to change teachers' dispositions and attitudes towards a content; consider teachers' needs such as handling the diversity in the classroom; and finally, plan the PD according to an ideal duration to provide teachers with the time to achieve the planned instructional change. There are several additional studies which also provided the teachers with PD on specific curriculum content areas such as literacy and mathematics. Even though not every study measured the outcomes with CLASS, these studies observed that teachers' instructional performance improved following the interventions (Englund, 2010; Powell et al.,

2010; Sipp, 2010). Longitudinal studies such as these provide us with a better picture of how *time* plays a role in changes in the scores and teachers' development, consistent with Bronfenbrenner's PPCT model. On the other hand, even though there are studies which showed improvements in Instructional Support following PD activities, the literature still does not provide sufficient information about ECE teachers' in-service PD experiences in terms of its quality and content (Egert et al., 2018).

Lastly, it would be helpful to discuss how strategies of PD related to Instructional Support has been delivered. In a recent study, Early and colleagues' (2017) randomly assigned ECE teachers to two different types of PD conditions, one of which was an instruction-based, small group, face-to-face intervention known as Making the Most of Classroom Interactions (MMCI), and the other one was My Teaching Partner (MTP) which is a remote one-to-one coaching approach. Early's study results indicated significant increases in all CLASS domain scores after MMCI; however, after MTP only Emotional Support scores were significantly higher. In contrast to the decelerating or insignificant results from online MTP coaching support in both Pianta et al. (2014B) and Early et al. (2017) studies, face-to-face MMCI indicated a linear increase in Instructional Support scores. Thus, these results imply that the delivery strategy is another predictor of instructional performance, and face-to-face strategies seem to be the most effective compared to online coaching. On the other hand, according to the current study results, the intensity of face-to-face mentor/coach visits do not seem to be significant predictor of Instructional Support scores. Although there is not sufficient information regarding content focus of the mentoring/coaching, based on the literature related to Instructional Support and the lower expectations in Head Start policies, we could speculate that the mentoring/coaching support would have to focus directly on skills that are measured on this domain in order to have an

impact. The overall results of RQ1.a, contributes to the mixed results in the literature on teacher related characteristics in relation to the CLASS Instructional Support.

Emotional Support (RQ1b)

Emotional Support domain of the CLASS measures classroom climate, teacher sensitivity, and regard for child perspectives. Therefore, it focuses on teachers' performance and whether they create warm, safe, responsive environments as they value children's interests and autonomy (Hamre et al., 2009; Pianta et al., 2008). In the current results, the mean score for Emotional Support domain is the highest among the CLASS domains ($Mean_{ES}$=5.43, sd=.56).

Parallel to the previous domain, the findings for the RQ1.b indicated that teacher-related variables are not significant predictors of classroom quality for the CLASS Emotional Support domain, except for the teachers with graduate degrees. As the teachers' level of education increase, their Emotional Support scores tend to decrease. As mentioned previously, teachers' education and classroom quality associations have been a debatable topic for years in the ECE field (Early et al., 2007; Whitebook, 2003). Results from studies that fuel these debates take three different turns: non-significant results, positive associations (i.e., the higher the qualifications, the higher classroom quality), and negative associations similar to the current result. It would be helpful to discuss this result from three angles. First, several studies did not indicate significant associations between teacher's education and overall classroom quality, including Emotional Support (Bulotsky-Shearer et al., 2012; Early et al., 2007; LoCasale-Crouch, 2007). However, in some of these studies, the samples did not include teachers with educational credentials higher than BA/BS degrees in their comparison groups (Bulotsky-Shearer et al., 2012; LoCasale-Crouch, 2007). The current study's sample, on the other hand, included teachers with academic experiences beyond the Bachelors degree, including graduate studies

(i.e., master's degree, doctorate degree, graduate/professional school experience but no degree), and the Emotional Support scores were lower for this group. Second, for the studies that found significant associations which were in the similar direction (i.e., as the level of education is higher, classroom quality is higher) (Burchinal et al., 2002; Pianta et al., 2005).

The third aspect for consideration of these mixed results are the inverse associations, such as the current finding (i.e., higher teacher education, lower Emotional Support). This type of associations could be interpreted along with Whitebook's (2003) assertion that highlighted the lack of clarity regarding classroom quality with advanced degrees beyond associate degrees. The association between teachers' degree levels and classroom quality is complicated because a number of factors impact teachers' practices. For instance, a study indicated that African American and Latino teachers who have less than BA degrees and serve low-income children have high levels of responsiveness when they aimed to benefit their community and received support in forms of mentoring and supervision throughout their career (Howes et al., 2003). Whitebook (2003) also mentioned that teachers with BA or higher degrees are more prone to leave their jobs when they were not satisfied with wages and worked with less educated teachers in less stable climate. Walter and Lippard (2017) found higher developmentally inappropriate beliefs (DIB) as the teachers' education levels increased. This study did not directly measure classroom quality, but the results are similar to the current study in that higher education levels were negatively associated with outcomes related to high quality classroom practices.

Overall, although these negative associations between classroom quality and teachers' education are open to speculations, the relevant literature implies that teachers might be more emotionally supportive according to their circumstances and expectations regardless of their education, as long as they feel committed and supported sufficiently (Howes et al., 2003;

Whitebook, 2003). Therefore, when measuring teachers' emotional supportiveness, it is important to capture their personal characteristics as well as their behaviors amenable to the PD activities because teachers' emotional responsiveness could be related to personal attitudes and dispositions. This point of view could reflect Bronfenbrenner's ideas which underline that an individual's proximal processes are also shaped with their personal characteristics. One last speculation to explain this negative association could perhaps point to the potential lack of practical experience and the enhanced theoretical knowledge gained in graduate level educational experiences. In this case, providing hands-on trainings to improve the practice quality regardless of teachers' level of education is important.

Classroom Organization (RQ1c)

The last domain of CLASS is Classroom Organization, which is focused on productivity, behavior management, and instructional learning formats (Hamre et al., 2009; Pianta et al., 2008). In other words, the teacher's performance is measured according to their time management skills for instruction and daily routines, addressing behavioral issues, as well as promoting children's engagement in the classroom activities are important aspects of this domain. This mean score in the current sample ($Mean_{CO}$ = 4.71, sd .74) approximates the competitive threshold of Head Start DRS standards (i.e., 5.0 for Classroom Organization).

When it comes to the teacher-level predictors, teacher's highest degree and intensity of mentoring/coaching are significant predictors of the Classroom Organization scores. Teachers with graduate/professional degrees tend to have lower Classroom Organization scores. This result is similar to the Emotional Support domain's findings, and the same speculation could be repeated that potential lack of job commitment and satisfaction as teacher gain more advanced

degrees, as well as practical experience as opposed to enhanced theoretical knowledge gained in graduate level.

Another significant predictor of Classroom Organization scores is the intensity of mentoring/coaching that teachers experience. Findings from the current study indicate that as teachers experience more intense mentoring/coaching in the classrooms, Classroom Organization scores tend to be lower. Parallel to this result, previously discussed Pianta et al. (2014B) study explored the associations between the dosage of PD and CLASS scores and provided similar conclusions to the current study. After a year of MTP online coaching cycles, results indicated an inverted U-shaped relationship between Classroom Organization scores and dosage, and they noted that Classroom Organization scores declined after a certain dose of coaching (7 cycles). In other words, the growth in teachers' Classroom Organization scores were not linear despite the increased doses of ongoing MTP coaching. This finding implies a continuously increased amount of mentoring/coaching support does not appear to be continuously effective. This inverse association between mentoring/coaching and Classroom Organization is also highly relevant to Bronfenbrenner's bioecological approach to human development. As discussed in the theory chapter, Bronfenbrenner asserted that extreme approaches to the time (i.e., disorganization or rigidity) could prevent potential growth and create detrimental outcomes (Bronfenbrenner & Morris, 2007). In other words, *consistency, stability, and predictability* are important considerations for most effective proximal processes (Bronfenbrenner & Morris, 2007, p. 820). In the current study's case, teachers reported the intensity of mentoring/coaching according to a range of responses from "none" through "weekly or more," which is a relatively high number of visits. Therefore, the current results are parallel to Bronfenbrenner's assertion; as the mentoring/coaching is more intense, the classroom organization scores tend to be lower.

Increased intensity of mentoring/coaching could lead to frequent disruptions in the classrooms' daily flow and create pressure on a teacher, which might impact the classroom climate and lower the classroom organization performance.

On the other hand, it is also important to note that the literature includes several studies indicating improvement in the teacher performance and classroom quality when there is mentoring/coaching involved (Onchwari & Keengwe, 2010; Son et al., 2013). However, as mentioned above, for the Instructional Support results from previous studies, the improvements cannot be explained only with intensity of mentoring/coaching; these improvements could be related to multiple variables including content, delivery strategies, and quality. Furthermore, these studies also assert that when multiple strategies are used, there is a stronger association between mentoring/coaching and their outcomes. Likewise, Bronfenbrenner also underlined the importance of regular and "progressively more complex" activities for advancing the development (Bronfenbrenner & Morris, 2007). This proposition could easily relate to the quality and content of mentoring/coaching activities. For achieving effective proximal processes via more complex PD and mentoring/coaching, activities should involve continuous, encouraging, and more complex interactions between teachers and PD providers

In addition to these literature and theory connections, it is also important to discuss these results specific to Head Start. Since the Head Start system requires ongoing mentoring/coaching support, this result could be discussed according to two possible directions. One side points to the teachers' performance; it is possible that after receiving certain periods of mentor/coach support, teachers may start feeling more efficacious that they can achieve the competitive threshold of DRS and may not be as motivated to reach a performance beyond that. The second possibility is to question the efficiency of mentors/coaches, and it moves the discussion once

again to the content and quality debate. Then we could speculate possible ineffective mentor/coach visits, which do not help teachers to progress.

Relatedly, the inverse association between intensity of mentoring/coaching and Classroom Organization scores from the RQ1c has implications for practice and policy. First, mentoring/coaching should be based on individual teachers' needs. In order to achieve this individualization, regular needs assessments should occur to improve intentionality and provide the optimal intensity of mentoring/coaching activities. With a needs assessment process, the support system could become more efficient in presenting enriched content and directions. Second, although this study did not address the content and quality of mentoring/coaching activities, these are most certainly important considerations for efforts to improve practice. It is helpful to remember three main considerations of effective PD: *who, what*, and *how* (La Paro & King, 2019; Winton & Snyder, 2015). Before providing mentoring/coaching support for teachers, Head Start staff should consider these three components. Lastly, aligning PD with professional standards and accountability systems should be an essential consideration (Kassner, 2014; Pianta et al., 2014). Head Start requires minimum 15 clock hours of in-service PD for the teachers in form of trainings and coaching (e.g., research-based strategies, intensive) (DHHS, 2016). However, despite the standards for increasing the quality of teacher performance, as mentioned previously, Head Start monitoring system does not have consistent quality thresholds for classroom quality to renew funding (i.e., 2.5 for Instructional Support, 5 for Emotional Support and Classroom Organization). Speculatively, these inconsistencies may easily lead to inconsistent mentoring/coaching practices to support the domains which are more demanding. For this reason, promoting alignment between teachers' PD standards and accountability system could be considered as a necessity to improve classroom quality. These alignments would help

with planning more strategic in-service PD opportunities, which match the expectations on teachers' qualifications and high-quality classrooms.

Overall, according to the results from RQ1, teacher related variables are mostly not significant predictors of CLASS domains. However, as discussed above, classroom quality reflects factors beyond the classroom, including children's context, center policies, and PD planning. In this regard, center directors are amongst the key personnel who are responsible to assure that the system works effectively. Moving from this point of view, these results direct us to the next research questions to test the ways that characteristics of directors may be related to classroom quality.

Director-related Predictors (RQ2a, 2b, 2c)

The second research question aimed to see whether center director characteristics are main predictors of the CLASS scores. The results indicated that there were no significant associations between selected characteristics of directors and the CLASS domains. These findings are somewhat parallel to the mixed results in the existing limited literature on ECE administrative processes and classroom quality. For instance, although there are similar insignificant findings between directors' educational background (Zinsser & Curby, 2014) and years of experience (Lower & Cassidy, 2007), a few studies indicated higher classroom quality (measured by ERSs) when directors had higher levels of education (Lower & Cassidy, 2007; Mims et al., 2008). On the contrary, global quality of an ECE center includes multiple layers in addition to classroom environment, such as staff, work environment, and administration (Lower & Cassidy, 2007). Relatedly, in the ECE literature, there are also studies which focused on the administrative quality in a more holistic way rather than focusing on directors' certain characteristics. They measured the administrative quality using PAS (Talan & Bloom, 2004) to

have an overall quality score regarding the administrative processes and compared these scores with classroom quality. Their results indicated positive associations between program/center administration quality and classroom quality (Lower & Cassidy, 2007; Yaya-Bryson et al., 2020). These meaningful correlations direct us to further inquiries to see the ways that directors interact within the processes in order to improve classroom quality. In this regard, the third research question aimed to test cross-level moderations to see how directors play role as moderators of the associations between teachers' in-service PD experiences and classroom quality.

Cross-level Interactions: Directors as Moderators (RQ3a, 3b, 3c)

In light of Bronfenbrenner's PPCT perspective, examining proximal processes considering the contextual interrelations to predict the teacher's in-service PD (i.e., proximal processes) and classroom quality is an essential component. As opposed to the previous results, the mixed models of the third research question (RQ3.a, 3.b., & 3.c) indicated significant moderations by director-level variables for the associations between teacher's in-service PD experiences (i.e., PD hours in assessment and curriculum, intensity of mentoring/coaching, T/TA participation) and CLASS scores. Since Bronfenbrenner's PPCT model emphasizes the importance of interrelatedness of contexts and individuals towards effective proximal processes, the current moderations are also parallel to the theoretical foundation of this study. Each CLASS domain is discussed according to the significant moderation findings.

Instructional Support (RQ3a)

The moderation results for the Instructional Support domain indicated several significant associations. In particular, *directors' educational background, years of experience, perceived*

management challenges, and *workload related to teachers* play significant roles in predicting classroom quality.

To start with, directors' educational background is a consistent moderator for the associations between teacher's different PD components and CLASS Instructional Support. More specifically, when directors have ECE/CD degrees and/or a higher degree than a BA, Instructional Support performance seems to be better despite the lack of T/TA and PD hours, and CLASS Instructional Support scores increase. This result is somewhat similar to Mims and colleagues' (2008) study, which indicated higher quality classrooms when directors had higher education levels. However, as mentioned above, their study used ERSs for measuring the quality, and they did not provide a conclusion specific to instructional support/quality.

When directors' years of experience increase, the association between teachers' in-service PD activities (i.e., intensity of mentoring/coaching and T/TA participation) and Instructional Support tend to have an inverse association. This means, as the directors have more years of experience, despite the teachers' decreased mentoring/coaching and T/TA activities, Instructional Support scores are likely to increase. Then one might speculate, when the directors are more experienced, they can support teachers in ways that increase the Instructional Support scores, even when the teachers do not receive structured mentoring/coaching and T/TA. In the ECE literature, previous studies have not explored this association for center directors. However, this finding related to directors' years of experience is important and implies system-level considerations. The directors who are new in a managerial position, may not be able to support teachers and classroom quality as much. For these cases, the Head Start system is expected to function proactively and provide PD opportunities for center directors to compensate the lack of experience.

Another significant result indicated that the directors' perceived management challenges are significant moderators between teachers' PD hours, receiving T/TA and Instructional Support scores. To be clear, if directors feel more challenged regarding their managerial position, they could have difficulties supporting teachers; in these cases, teachers' PD hours on assessment may be more beneficial and be associated with increased Instructional Support scores. On the other hand, when directors spend more time working with teachers by *designing the training and technical assistance plan for this center, evaluating teacher and other staff,* and *providing educational leadership/establishing the curriculum* (measured by *workload related to teachers* in the current study), higher Instructional Support scores might be observed even if teachers are not participating in external T/TA and PD experiences. Therefore, a director could create a support system and compensate for formal PD activities on assessment that staff do not receive. However, to achieve this level of support, directors need to experience less challenges in their managerial duties and dedicate more time for teachers and supporting their curriculum. These thoughts regarding the processes that might underlie the findings related to how directors' characteristics and experiences moderate the relationship between teachers' characteristics and observed scores on Instructional Support are similar to the implications proposed in several studies that have examined the intersections between teachers' characteristics, directors' characteristics, and classroom quality (Cassidy et al., 2011; Mims et al., 2008; Zinsser & Curby, 2014). These studies emphasized that when directors' job satisfaction is high, and they do not feel stressed or burned-out, they act more efficiently in the center and they provide beneficial resources for teachers. Relatedly, in a recent study by Lawrence et al. (2020), teacher-reported levels of support from their administrator (or school) were positively associated with higher scores on all three CLASS domains, including Instructional Support. To conclude, center

directors' characteristics and experiences are significant moderators in the associations between teachers' in-service PD experiences and CLASS Instructional Support scores.

One last result from this model indicated that for the directors who perceive more challenging managerial duties (measured by *directors' perceived management challenges)*, the association between teacher's PD hours in curriculum and Instructional Support scores became strongly negative. This means that when directors feel challenged, even if teachers' PD hours in curriculum are limited, Instructional Support scores are still likely to be higher. This particular finding is different from the overall remaining findings, and this distinction could be related to directors' other background qualifications, such as directors' knowledge on the curriculum and previous teaching experience which were not measured in this study. Another potential speculation could be related to the teacher preparation processes; in other words, the quality of pre-service trainings on curriculum might remain effective and could overcome the lack of formal PD curriculum. However, this speculation is beyond the results of this study, and still not sufficient to explain this finding.

Emotional Support (RQ3b)

Despite the absence of main effects, directors' characteristics act as significant moderators between teachers' in-service PD activities and CLASS Emotional Support scores. To start with, directors' educational background is an important moderator between teachers' PD activities and Emotional Support performance. For instance, center directors' field of education moderates the relationship between the intensity of mentoring/coaching and T/TA that teachers receive and their scores on the Emotional Support domain. As for intensity of mentoring/coaching, when the directors do not have ECE/CD related degrees, receiving more intense mentoring is associated with higher Emotional Support scores. This means that directors'

field of education is an important consideration when providing mentoring/coaching for teachers to improve Emotional Support performance in the classrooms. Similarly, for the teachers who did not receive and do not know whether they received T/TA in the last year and had directors lacking ECE/CD degrees, the associations were strongly positive. In other words, Emotional Support scores tend to decrease when both teachers and directors do not meet certain characteristics and experiences. Likewise, for the directors holding graduate degrees, the associations tend to be negative between teachers' structured PD hours on curriculum and Emotional Support scores. As cited previously, Mims and colleagues (2008) highlighted the importance of director's level of education as a predictor of classroom quality. However, in a more recent study, in their MLM with FACES 2009 data, Zinsser and Curby (2014) did not find any association between director's level of education and CLASS Emotional Support scores. Therefore, the current study has both confirmatory and conflicting results compared to the literature.

Lastly, the association between PD hours on curriculum with Emotional Support scores is also moderated by directors' teacher-related workload. Perhaps when directors dedicate more of their workload to work intensely with teachers, teachers have less need for those PD hours to increase their CLASS scores. In other words, as mentioned before, support from the director might take the place of PD experiences; when teachers feel supported in curriculum by, they may feel less stress and become more emotionally responsive in the classroom. Some studies in the literature highlight the importance of center directors' educational leadership and workload issues as a potential influence on the quality of teachers' teaching practices. Studies have shown negative implications of excessive workload and stressors for center directors (Cassidy et al., 2011; Mims et al., 2008; Zinsser & Curby, 2014). Cassidy and colleagues (2011) defined a group

of directors that they termed “proactive directors.”. Their study emphasized the importance of proactive leadership during turnovers and new teacher transitions, and indicated that proactive directors work with teachers closely to meet their needs, answer their questions, and provide resources. Therefore, perhaps center directors who dedicate a specific amount of their workload to work with their teachers regarding curriculum and educational leadership act as proactive leaders and contribute to improvements in the quality of classrooms.

Classroom Organization (RQ3c)

Parallel to the previous CLASS domains, the moderation effects consistently show up in the associations between teacher’s in-service PD experiences and Classroom Organization scores (RQ3.c). For instance, director’s workload related to teachers consistently moderates the PD hours in both curriculum and assessment, and intensity of mentoring/coaching as predictors of Classroom Organization scores. For the directors who work with teachers closely, the intensity of PD hours and mentoring/coaching does not necessarily associate with higher Classroom Organization scores. In other words, one might speculate that as directors provide immediate and onsite support during daily routines, teachers’ Classroom Organization scores may be higher even if they have not had structured PD hours and mentoring/coaching.

Once again, directors’ educational backgrounds are an important moderator between teachers’ in-service PD activities and Classroom Organization scores. Specifically, results indicate that directors’ ECE/CD degree moderates teachers’ mentoring/coaching and T/TA participation as predictors of the classroom quality. When directors lack ECE/CD degrees, the associations between structured PD activities (i.e., mentoring/coaching and T/TA) and Classroom Organization scores become positive and stronger. This is an intriguing result in terms of emphasizing the importance of ECE directors’ field of education. In previous studies,

even though the higher degrees seemed to associate with better organizational climate, teacher performance, and classroom quality (Cassidy et al., 2011; Mims et al., 2008), the literature did not indicate significant associations according to directors' field. Therefore, it would not be wrong to assert that educational background of directors, including their field and highest degree, are both important variables to consider for predicting teachers' performance and classroom quality. Lastly, as the director's years of experience increase, the association between T/TA and Classroom Organization does not remain positive. This finding is also parallel to the previous domains; when directors have more experience, they can perhaps more effectively support teacher's in-service PD, resulting in higher Classroom Organization scores even when teachers have not experienced structured PD activities.

Implications for Center Directors

These results from the current study have important system-level implications. In spite of the significant cross-level moderations underscoring the center directors' potential influence, their qualifications and roles are not acknowledged sufficiently in regulations; the Head Start PPS do not explicitly define the requirements for being a center director. Results of the current study indicated that as the directors hold ECE/CD related degrees and often graduate degrees, they support the teachers' PD experiences and accordingly, the classroom quality is likely to increase. These results imply that Head Start system should set the required qualifications in more specificity for hiring center directors. This implication could easily translate to the overall ECE system to seek for directors who are qualified in the field.

Relevant literature emphasizes directors' work overload (Caruso & Fawcett, 1999; Cassidy et al., 2011). Considering their workload, when defining the hiring requirements, clear job descriptions are needed for center directors. Findings of this study showed that as directors

dedicated time to work with their teachers, the CLASS scores were higher despite the decrease in teachers' structured PD activities. On the other hand, directors who felt more challenged with their current position had the opposite interactions within the processes. Therefore, constructing a support system and fair job descriptions for center directors would support teachers' PD needs and improve the quality in the classrooms. In other words, the amount of structured PD activities and intensive need for PD providers would decrease as the teachers' initial needs are compensated within the immediate center context with directors' supervision.

Since the years of experience for directors seems to be an important moderator within the centers, the Head Start system could act proactively by supporting newly hired directors in varied ways to improve their transition and improve the dynamics of their work with teachers. Orientations, including trainings and shadowing, would help with the initial process. However, these efforts should be followed by regular PD activities especially during the directors' first few years. The literature indicates that Head Start center directors do not attend in-service PD activities as much as the program directors (Harding et al., 2019B). Bloom and Sheer's (1992) study indicated that PD interventions for center directors increase the classroom quality. Therefore, providing structured and regular PD support for center directors would not only support center-level dynamics but also system-level improvements. Parallel to *who, what,* and *why* components for planning teachers' PD, the same components should be considered for directors' PD activities (La Paro & King, 2019; Winton & Snyder, 2015). Therefore, according to their needs, a variety of content and delivery strategies could be implemented. Lastly, mentoring/coaching practices in Head Start could apply for center directors as well. Regular mentoring and consultation support could improve their ongoing practice as well as well-being while they are juggling multiple duties within the center.

Overall, efforts to improve classroom quality must extend beyond observing the environment and interactions within the classroom and making connections to teacher-related qualifications. Instead, it requires rethinking the contextual factors outside the classroom when designing research as well as a formal quality monitoring system. Therefore, for assuring increased classroom quality, research and policy attempts should enhance considerations towards center context and director-related factors, in addition to classroom and teacher-related factors. The current study provided the literature with important considerations for classroom quality in relation to teacher and director interactions.

Strengths and Limitations

The current study has several strengths. First, it provides us with the information from a large, nationally representative sample from Head Start. As a large federal program serving the nation's most vulnerable children, Head Start has historically acted as a "national laboratory" for ECE. Thus, results of the current study provide a good picture of the relationships between teachers' and directors' characteristics and classroom quality in the federal Head Start context.

The research literature has produced contradictory and unexpected findings when exploring the relationship between teacher characteristics and classroom quality. A significant strength of this study is the aim to explore potential factors that may underlie these mixed results, highlighting the relationships between teacher characteristics, classroom quality, and center-level factors. Specifically, the current study focuses on a neglected area in the research literature by exploring the ways that directors play roles in the relationship between teachers' in-service PD experiences and classroom quality. Unpacking the contribution of director-related factors such as their educational background, workload, and perceived managerial challenges provides the field

with a deeper understanding of the center-level processes that are related to the teachers' in-service PD experiences and classroom quality.

Furthermore, the study examined multiple types of in-service PD activities instead of focusing on one type of PD activity. Including varied types of PD activities (i.e., PD hours in curriculum and assessment, mentoring/coaching, and T/TA) in the analyses brings a better understanding regarding the intensity/frequency of existing PD practice for Head Start teachers. Parallel to PPCT model, this also gives us some understanding of teachers' proximal processes and some indication that perhaps interactions with their center directors may facilitate improvements in classroom quality.

Another strength of this study is the analytic approach. Using HLM strengthens the study because this approach handles the similarities within centers as the models account for the between center differences. HLM strengthens our understanding of the center-level processes (i.e., center directors' characteristics and professional experiences) that may be contributing to teachers' practices and informs efforts to improve teachers' PD and in turn, classroom quality. This analytic approach is consistent with Bronfenbrenner's PPCT model, which emphasizes the importance of contextuality and developmental processes. In this regard, center directors seem to be part of the contextual factors that influence Head Start teachers' classroom performances; they may play roles in their in-service PD experiences and, as supervisor, promote improvements in the education services. Therefore, the theoretical and statistical models work hand in hand to explain these dynamic interactions in the occupational contexts of the ECE workforce. The current results provided new considerations and comprehensive implications to understand and elevate the ECE quality within Head Start classrooms considering the intersectionality of workforce characteristics and experiences.

Despite the strengths, this study also has several limitations. Analyzing a secondary dataset brings certain boundaries to the research. First, the constructs were measured with the existing FACES survey questions. In other words, the researcher did not have the chance to decide how to measure constructs with different data collection tools. According to the available data in FACES, the questions related to in-service PD experiences were limited to whether they received different types of PD. Inevitably, this limited the ability to thoroughly explore the content and quality of teachers' and directors' PD activities. When it comes to classroom quality, the current study is limited to the process quality measured by CLASS. Aside from process quality, measuring structural quality would provide information about the physical conditions and resources, including furniture, materials, and the like. These are important factors for organizing the daily routines. Therefore, the current study mostly addressed process quality in the classrooms and did not emphasize structural quality.

As mentioned in the methodology chapter, HLM is a sample sensitive technique and requires sufficient size of sample in each level. Thus, another methodology-related limitation is the sizes of the clusters in each center. Although the number of centers is sufficient, each center provided around two classroom/teacher cases. This limited the number of variables that could be included in the models and meant that the study was not able to test random slopes; the results are limited to the fixed effects (i.e., intercepts and slopes) and random intercepts. Relatedly, the given associations involve conditional effects due the number of study variables.

Even though this study handles a large nationally representative sample for the federal Head Start system, the results are limited to this particular ECE system, and cannot be generalized to the other ECE program sectors and types. Also, the teacher and director experiences may still involve selection effects, which were not taken into account in this current

data and study results. Lastly, as being cross-sectional, this study presents neither any longitudinal conclusions over time such as changing practices and professional development of the workforce nor any causality and directionality.

Future Directions for Research

Overall, this exploratory study contributes to the literature by offering further considerations regarding the relationships among the center context, workforce interactions, and classroom quality. However, there is a need for future inquiry to unpack the relationships between teachers and center directors for increased quality in ECE settings. Future research directions could include different study designs, improved data collection tools, and diverse samples to explore these concepts and address the previously mentioned limitations.

Regarding the study design, conducting longitudinal studies to explore statistical interactions among teacher and center directors' characteristics and classroom quality within centers is an essential future direction. It will be important to design studies that address causality and eliminate the validity threats of cross-sectional studies. Instead of retrospective experiences reported by the workforce and quick snapshots of ECE environments, conducting more in-depth research should be considered for the next research steps. The dynamic structure of ECE environments could be measured with extensive observations of organizational climate and classroom quality, along with longer periods of interventions for workforce to test improvements in practice and center climate. These longer periods –depending on the study purposes-- would help implement experimental designs with increased validity as well as test the outcomes of these interventions. For instance, Instructional Support domain could be a main interest for a future study. As the results indicated these scores are more dependent to the center-level factors more than the other two domains, it is important to conduct interventions with

targeting both teachers and directors. These interventions would help us to see how proximal processes occur during time teacher-director interactions, and whether they change classroom quality over time.

In addition to longitudinal and experimental studies, qualitative design studies would enrich the potential data and conclusions. For instance, conducting phenomenological studies to gather in-depth information on the topics such as ECE workforce's PD quality and content, directors' managerial roles and challenges, and organizational interactions and climate would lead to more comprehensive conclusions. Semi-structured, one-to-one and focus group interviews with ECE teachers and directors would help the researchers to probe their experiences, which would inform the researchers, practitioners, and policymakers in detailed ways to help further understand the associations among teachers' and center directors' characteristics and professional experiences, and classroom quality. The current negative associations between teachers' level of education and classroom quality scores imply another potential qualitative study objective. This study could aim to explore the teachers' level of education and their approach to the occupation (e.g., experiences, satisfaction, commitment, expectations) to unpack these associations providing with more details.

Another consideration to expand the focus, quality, and quantity of relevant data is to revise/redesign the data collection tools in national data collection efforts such as FACES. The current teacher surveys do not provide information about teachers' perceptions/feedback related toto their in-service PD. The lack of content and quality information could be overcome with the help of in-depth survey questions addressing teachers' in-service PD experiences and expectations. Aside from teachers, there is still a need for further information regarding ECE directors as well. In light of the results of this study, directors' educational backgrounds and

years of experience have important roles within the center dynamics. However, neither FACES surveys nor the existing literature involves detailed data collection tools to shed light on ECE directors' in-service PD and their perceptions regarding these experiences. Therefore, there is quite limited data about directors' PD. In addition to PD, perceptions regarding organizational climate are needed from both teachers' and directors' perspectives. For these potential areas of ECE research, both small and large-scale studies would address the gaps in the field. With the help of detailed tools, it will be possible to capture center dynamics between individuals across the ECE system.

Another future direction for research is to diversify the sample. FACES datasets help researchers, policymakers, and practitioners better understand ongoing Head Start service quality, providing a nationwide picture of the program. In particular, the current study's results demonstrated how the interactions between center directors and teachers could relate to classroom quality. However, the ECE system in the United States is not limited to the Head Start context. State-level ECE systems consist of multiple types of programs including for-profit and non-profit sectors with varied settings (e.g., chains, private schools, religious affiliations, independent centers). Thus, designing studies to recruit these different types of programs would advance our understanding about the associations between workforce and classroom quality more holistically.

Despite the commonalities in the operations of ECE programs, each sector and type of program has unique features. For instance, Head Start targets a specific population –low-income families-- and provides their services free of charge. Also, Head Start requires programs to compete for federal funding every five years in order to stay in the system. Another nuance of Head Start points to the formal evaluation measure; CLASS is the quality measure of the

monitoring system. In contrast to Head Start, the majority of the remaining program types are regulated according to their state-wide QRISs. Although these QRISs aim to provide similar sets of standards and practices regarding quality within the state, due to the inevitable differences among the states, it is difficult to make feasible comparisons and conclusions about nationwide practices. Regarding the aforementioned features (i.e., target population, education charges, quality measurement tools), each QRIS can vary. Furthermore, expected workforce qualifications, required in-service PD training, ECE licensures may differ from state to state. Therefore, conducting studies in these varied contexts is needed to have deeper understanding of the overall ECE system in the US, in terms of center climate, workforce PD and interactions, and classroom quality.

Conclusion

The current study aimed to explore the predictors of Head Start classroom quality in relation to the teachers' characteristics and experiences, and center directors' characteristics. The study's theoretical foundations are rooted in Bronfenbrenner's PPCT model, which approaches the Head Start teachers as developing individuals, and center directors as the facilitators of teachers' in-service PD experiences for increased classroom quality (i.e., as measured by the CLASS by Pianta et al., 2008). From this point of view, the FACES 2014 data was analyzed using mixed multilevel models to capture the contextuality within the centers across the nationally representative Head Start sample.

In terms of teachers as the main predictors, the results for the first research question indicated that very frequent (i.e., in the current study, measured highest intensity was *once a week or more*) mentoring/coaching support could be associated with lower Classroom Organization scores. This finding implied the importance of content and quality of the teacher

support, rather than its intensity. Furthermore, findings indicated a negative association between CLASS scores and the level of education for teachers, contributing to the years' long debate on the relationship between teacher education and classroom quality. These results were discussed according to teachers' potential background variables such as personality, commitment, and support systems and teachers' potential need for hands-on PD activities to improve their classroom practices.

With regard to the center directors, although they did not appear to be the main predictors of CLASS scores, they were significant moderators between teachers' in-service PD experiences and classroom quality. Results indicated that when directors had higher level of education (i.e., graduate degrees), ECE/CD-related degrees, higher years of experience, and more workload related to teachers, the CLASS scores were higher, despite the teachers' decreased in-service PD experiences. On the contrary, when directors felt more challenged regarding their managerial duties, classroom quality scores were positively associated with teachers' in-service PD experiences.

The overall results shed light on the ways that teachers' in-service PD experiences and center directors' potential roles within Head Start centers. These results indicate future directions for policy and research and promote a more holistic approach to understanding the operations of ECE systems, including Head Start.

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APPENDIX A: FACES 2014 STUDY DESIGN

The latest FACES 2014 data collection occurred during three periods: Fall 2014, Spring 2015, and Spring 2017. Throughout these three periods of data collection, different measures and a different sample were used in each wave. Therefore, the FACES 2014 dataset is not in a longitudinal structure. Data from 2014-2017 is the sixth of the FACES series of data collection, and it consists of multiple core sets of data (i.e., Core studies), as well as additional special studies which are called topical modules (i.e. Plus studies). The next subsections explain the content of these Core and Plus studies.

Classroom core

Classroom core is the focus of the proposed study. This core measured program, center, classroom, and staff characteristics through classroom observations, teacher surveys, and director surveys. Classroom core data was collected in Spring 2015 and Spring 2017. Trained FACES classroom observers conducted onsite observations in Head Start classrooms using standardized measurements. These measures provided descriptive statistics for classrooms (e.g. class size, child/staff ratios), and quality scores on structural and process components. The short form of The Early Childhood Environment Rating Scale–Revised (ECERS–R; Clifford et al., 2005; Harms et al., 2005) was one of the measures used to observe classrooms. The short form that was used included 21 items and two factors, *teaching and interactions* (ongoing interactions and process quality), and *provisions for learning* (structural components such as materials, classroom space).

The Pre-K Classroom Assessment Scoring System (CLASS; Pianta et al., 2008) was the second classroom observation tool in FACES. This tool measures the process quality of the

classroom with a focus on the interactions between teachers and children. It consists of three domains: emotional support, classroom organization, and instructional support.

The staff surveys included the Core Teacher Survey and Head Start Director Surveys. The Core Teacher Survey involved several sub-surveys to ask about teachers' classroom experiences (e.g., curriculum, assessment), professional background and demographics, and ongoing professional development opportunities, as well as their beliefs and perceptions about their mental health and occupation.

The last portion of this core includes Head Start Director surveys targeting both program directors and center directors. These surveys aimed to explore both the program- and center-level characteristics in terms of processes, staff, and directors. Since the scope of the proposed study is Classroom Core study, the details of the data collection tools are provided in *The Present Study* section.

Classroom + child outcomes core

Classroom + child outcomes core highlights information about the children and families included in the study. FACES assessed children's school readiness outcomes with direct assessments completed by assessors and teachers. These outcomes include a child's cognitive development (language, literacy, and mathematics), physical development (height and weight), and executive functions. FACES assessors used standardized tests including the Peabody Picture Vocabulary Test-Fourth Edition (PPVT-4) and the Woodcock-Johnson III to assess children's developmental outcomes (Dunn et al., 2006; Woodcock et al., 2001, 2004).

In addition to the direct assessments of children, teachers provided Teacher Child Report (TCR) forms. These forms were adapted from different measures (e.g. National Household Education Survey, Personal Maturity Scale) and provided data about children's accomplishments

in cognitive areas, cooperative classroom behaviors, problem behaviors, approaches to learning, and their developmental conditions and concerns. In FACES 2014, data for child outcomes comes from only 2014-2015 Head Start year (pg. 85-92).

Lastly, the core parent survey is included within the classroom+child outcomes core study. This survey included questions on child and family demographics such as home language, employment, public assistance, household income, and structure. Besides demographics, there were questions on home experiences such as assessment of the learning environment and child-care arrangements, as well as parents' mental health. Core parent surveys were conducted by phone calls or online.

Plus studies

In addition to core studies, *Plus* studies were conducted as part of redesign and improvement efforts for existing FACES tools. They included five different modules: 1) Family Engagement Plus study, 2) Five essentials measurement system for early education (5E-Early Ed) Educator Survey pilot study, 3) The American Indian and Alaska Native Head Start Family and Child Experiences Survey (AI/AN FACES 2015), 4) Head Start Program Performance Standards Plus, and 5) the Plus topical module on program functioning using the Early Ed Essentials (Early Ed Essentials Plus module) (Klein et al., 2018). These studies were included either to pilot a survey or to collect in-depth data from the participants. FACES 2014 data collection components according to the time point are summarized in Table 13.

Table 13. FACES 2014 Data Collection Components by Time Point

	Fall 2014	Spring 2015	Spring 2017
Direct child assessment	X	X	
Parent survey	X	X[a]	
Teacher Child Report	X	X	
Teacher survey		X[a]	X[b]
Classroom observation		X	X
Program director survey		X	X[c]
Center director survey		X	X[c]
Family Engagement parent interview		X	
Family engagement – Family service staff (FSS) interview		X	

(Klein et al., 2018, pg. 72)

[a] Included Family Engagement Plus Study

[b] Included Early Ed Essentials Plus(Early Ed Essentials Plus module)

[c] Included Head Start Program Performance Standards Plus

Among these three periods, program and class level data collection occurred in both Spring 2015 and 2017. With consideration for new programs entering to the Head Start universe or old programs dropping from the system (i.e., loss of funding) following the initial selection, the sample was refreshed to reflect the national population in Spring 2017 (Klein et al., 2018). However, the sample did not change completely and still included participants from 2014 and 2015. At the end, each period's sample included multiple strata including programs, centers, children and families, and teachers and directors.

APPENDIX B: HLM OUTPUTS FOR FULLY UNCONDITIONAL MODELS

FULLY UNCONDITIONAL-INSTRUCTIONAL SUPPORT
Specifications for this HLM2 run
Problem Title: no title

The maximum number of level-1 units = 646
The maximum number of level-2 units = 301
The maximum number of iterations = 100
Method of estimation: full maximum likelihood

Weighting Specification

	Weighting?	Weight Variable	Normalized?	Type
Level 1	yes	TO2CLSWT	yes	marginal
Level 2	no			
Precision	no			

The outcome variable is O2CLSSIS

Summary of the model specified
Step 2 model
Level-1 Model

$$O2CLSSIS_{ij} = \beta_{0j} + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

Mixed Model

$$O2CLSSIS_{ij} = \gamma_{00} + u_{0j} + r_{ij}$$

Run-time deletion has reduced the number of level-1 records to 552
Run-time deletion has reduced the number of level-2 groups to 291

Final Results - Iteration 32
Iterations stopped due to small change in likelihood function

$\sigma^2 = 0.23364$

Standard error of $\sigma^2 = 0.02018$
τ

INTRCPT1,β_0 0.46612

Random level-1 coefficient	Reliability estimate
INTRCPT1,β_0	0.736

The value of the log-likelihood function at iteration 32 = -6.524660E+002

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	2.456848	0.045807	53.635	290	<0.001

Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	2.456848	0.045807	53.635	290	<0.001

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.68273	0.46612	90	1389.55738	<0.001
level-1, *r*	0.48337	0.23364			

Statistics for the current model

Deviance = 1304.932014

Number of estimated parameters = 3

FULLY UNCONDITIONAL-EMOTIONAL SUPPORT
Specifications for this HLM2 run
Problem Title: no title

The maximum number of level-1 units = 646
The maximum number of level-2 units = 301
The maximum number of iterations = 100
Method of estimation: full maximum likelihood

Weighting Specification

	Weighting?	Weight Variable	Normalized?	Type
Level 1	yes	TO2CLSWT	yes	marginal
Level 2	no			
Precision	no			

The outcome variable is O2CLSSES

Summary of the model specified
Step 2 model
Level-1 Model

$$O2CLSSES_{ij} = \beta_{0j} + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

Mixed Model

$$O2CLSSES_{ij} = \gamma_{00} + u_{0j} + r_{ij}$$

Run-time deletion has reduced the number of level-1 records to 552
Run-time deletion has reduced the number of level-2 groups to 291

Final Results - Iteration 63
Iterations stopped due to small change in likelihood function

$\sigma^2 = 0.15652$

Standard error of $\sigma^2 = 0.01320$

τ

INTRCPT1, β_0	0.11689

Random level-1 coefficient	Reliability estimate
INTRCPT1,β_0	0.530

The value of the log-likelihood function at iteration 63 = -4.350400E+002

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	5.465220	0.027388	199.547	290	<0.001

Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	5.465220	0.027388	199.547	290	<0.001

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.34190	0.11689	290	726.95429	<0.001
level-1, *r*	0.39563	0.15652			

Statistics for the current model

Deviance = 870.079938

Number of estimated parameters = 3

FULLY UNCONDITIONAL – CLASSROOM ORGANIZATION
Specifications for this HLM2 run
Problem Title: no title

The maximum number of level-1 units = 646
The maximum number of level-2 units = 301
The maximum number of iterations = 100
Method of estimation: full maximum likelihood

Weighting Specification

	Weighting?	Weight Variable	Normalized?	Type
Level 1	yes	TO2CLSWT	yes	marginal
Level 2	no			
Precision	no			

The outcome variable is O2CLSSCO

Summary of the model specified
Step 2 model
Level-1 Model

$$O2CLSSCO_{ij} = \beta_{0j} + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

Mixed Model

$$O2CLSSCO_{ij} = \gamma_{00} + u_{0j} + r_{ij}$$

Run-time deletion has reduced the number of level-1 records to 551
Run-time deletion has reduced the number of level-2 groups to 291

Final Results - Iteration 63
Iterations stopped due to small change in likelihood function

$\sigma^2 = 0.26730$

Standard error of $\sigma^2 = 0.02266$

τ

INTRCPT1, β_0	0.22345

Random level-1 coefficient	Reliability estimate

INTRCPT1,β_0	0.556

The value of the log-likelihood function at iteration 63 = -6.144376E+002

Final estimation of fixed effects:

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	4.742822	0.036888	128.573	290	<0.001

Final estimation of fixed effects (with robust standard errors)

Fixed Effect	Coefficient	Standard error	*t*-ratio	Approx. *d.f.*	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	4.742822	0.036888	128.573	290	<0.001

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	*d.f.*	χ^2	*p*-value
INTRCPT1, u_0	0.47271	0.22345	290	761.61803	<0.001
level-1, r	0.51701	0.26730			

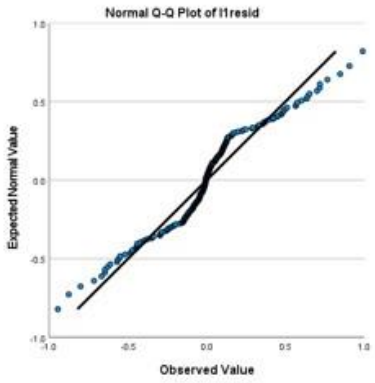
Statistics for the current model

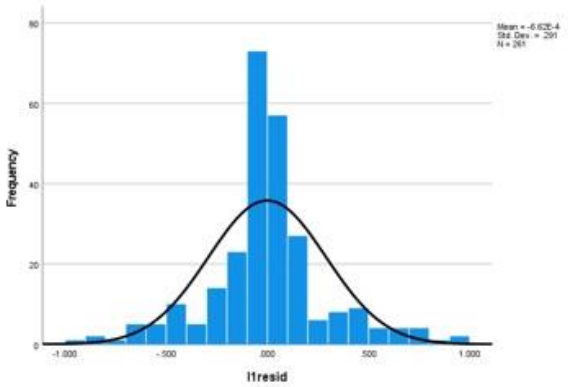
Deviance = 1228.875107

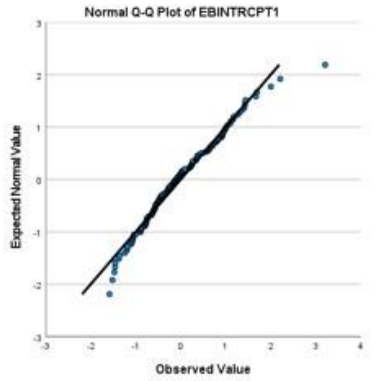
Number of estimated parameters = 3

APPENDIX C: RESIDUAL DISTRIBUTIONS

Figure C 1. Residual Distributions for RQ1 & 2 – Instructional Support Outcome







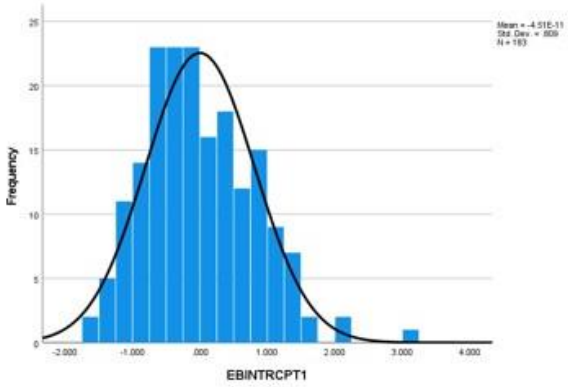


Figure C 2. Residual Distributions for RQ1 & 2 – Emotional Support Outcome

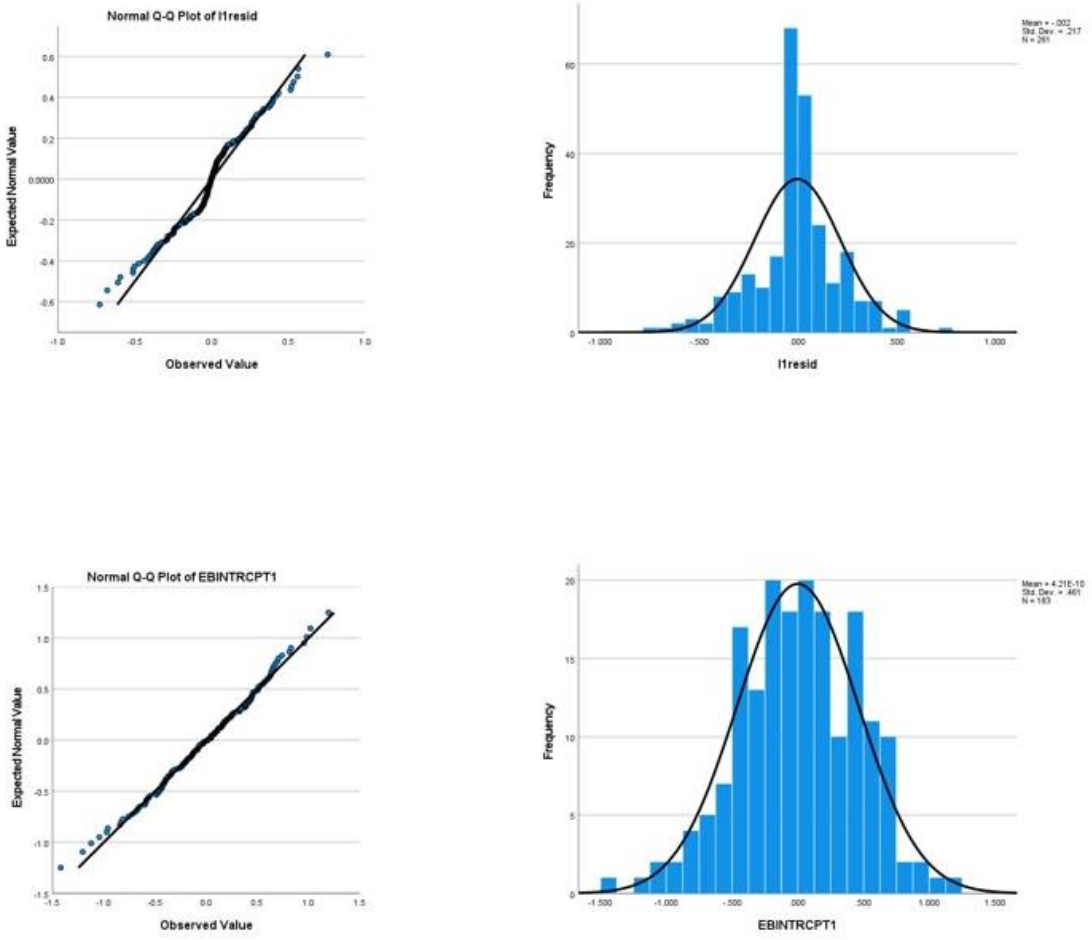
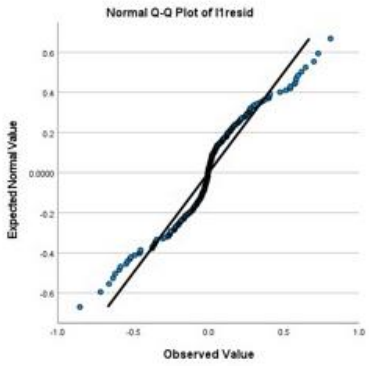
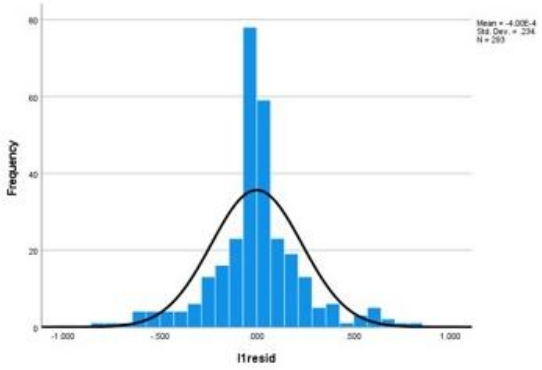
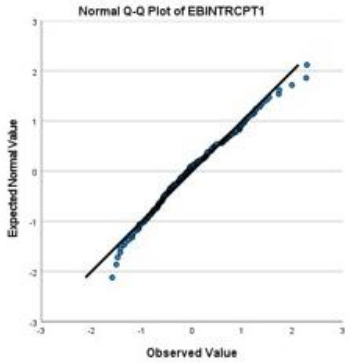


Figure C 3. Residual Distributions for RQ1 & 2 – Classroom Organization Outcome







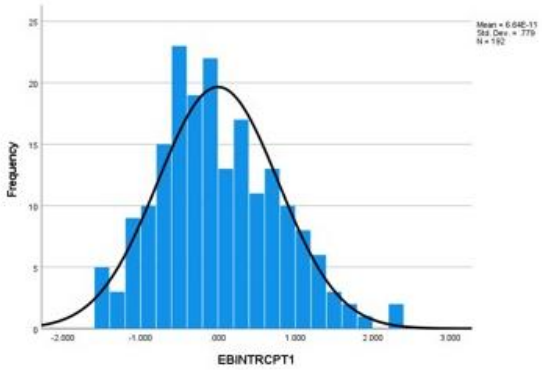


Figure C 4. Residual Distributions for RQ3 – Instructional Support Outcome

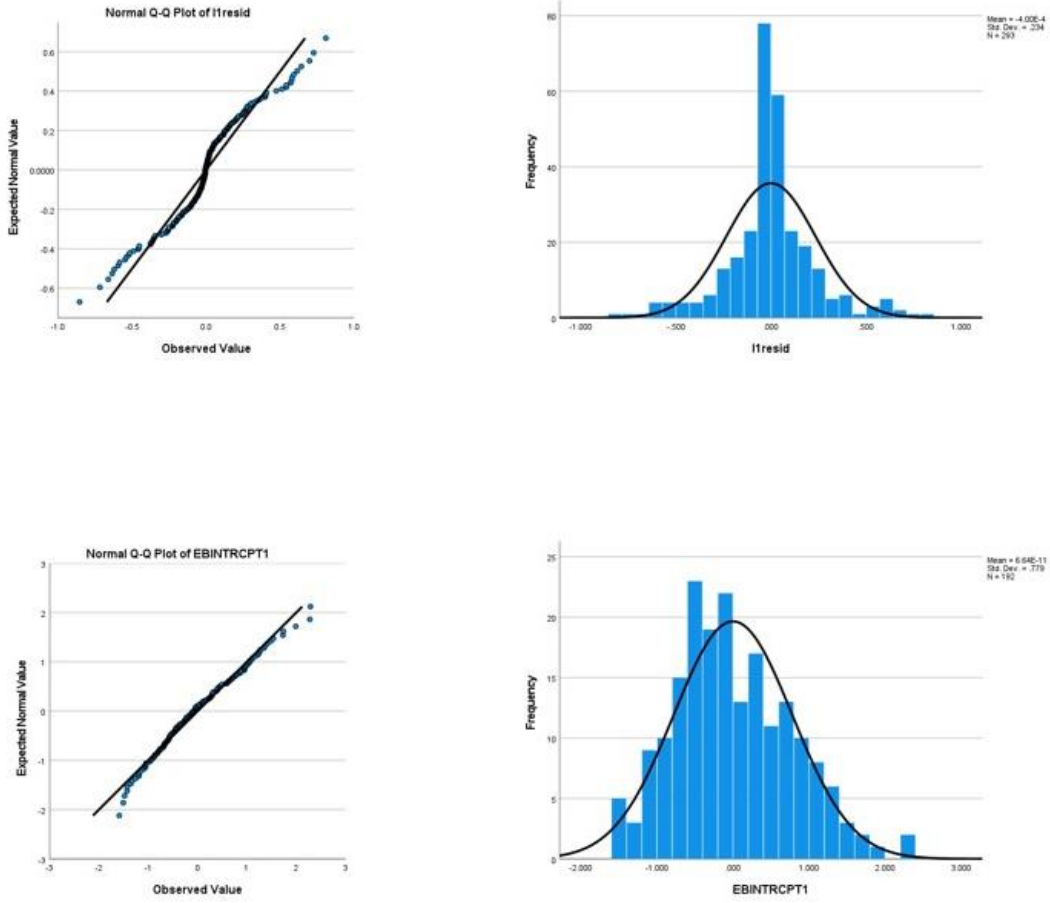


Figure C 5. Residual Distributions for RQ3 – Emotional Support Outcome

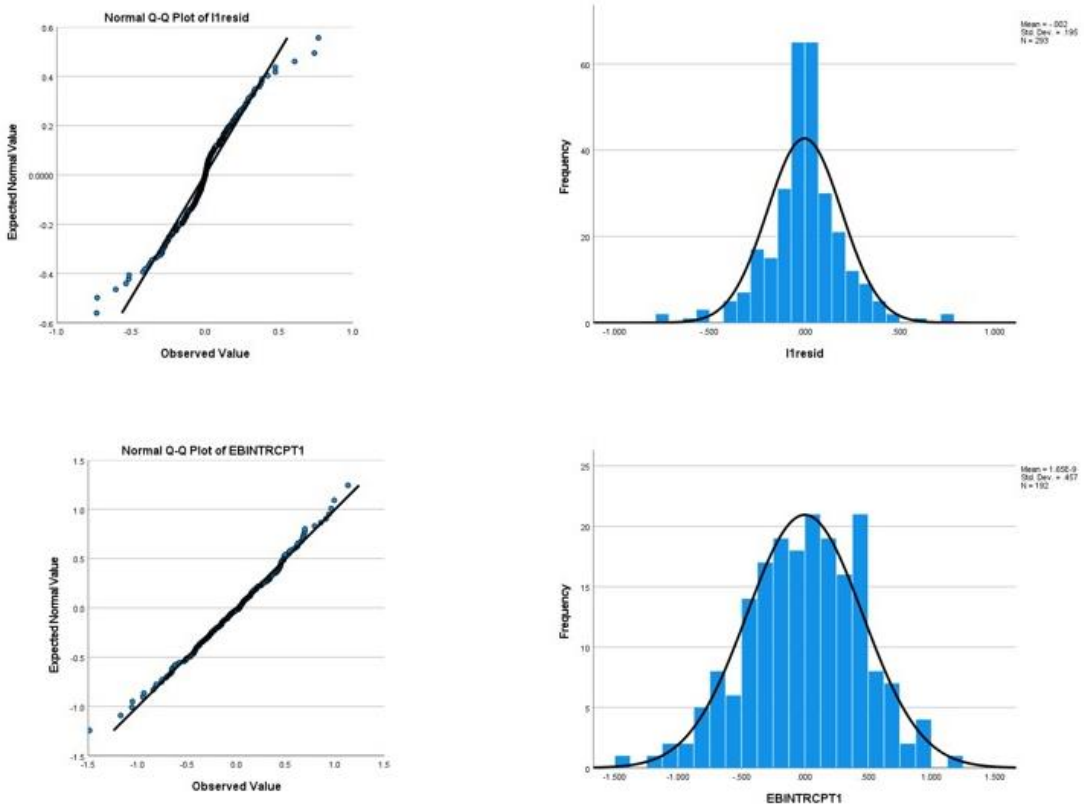
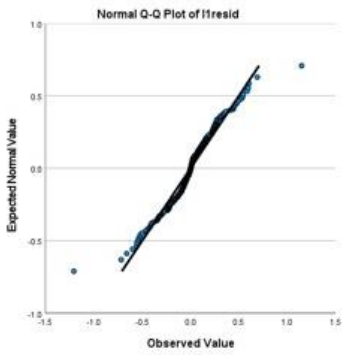
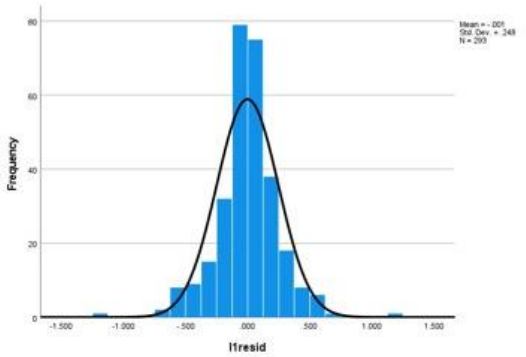
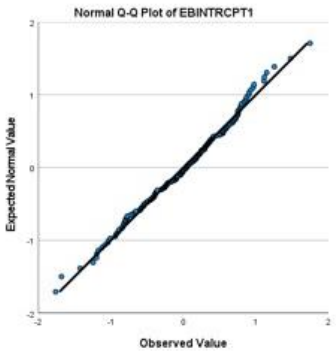
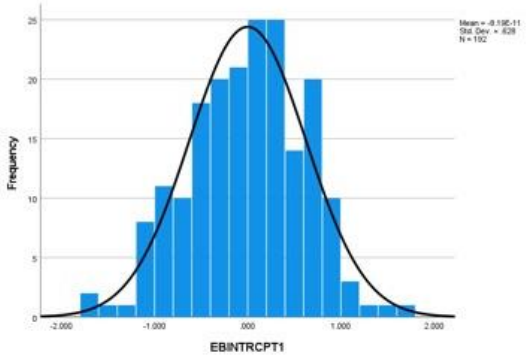


Figure C 6. Residual Distributions for RQ3 – Classroom Organization Outcome









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APPENDIX D: DESCRIPTIVE STATISTICS FOR THE EXCLUDED 45 CENTERS/CLASSROOMS

Table 14. Descriptive Statistics of Study variables for the excluded 45 centers/classrooms

Level-1 Descriptive Statistics (Classroom/Teacher)						
Variable Name	**Valid N**	**Mean**	**Sd**	**Min**	**Max**	**Cohen's D**
Outcome variables						
CLASS Instructional Support	45	2.68	0.99	1.16	5.00	.26
CLASS Emotional Support	45	5.45	0.47	3.87	6.31	.03
CLASS Classroom Organization	45	4.74	0.60	3.25	5.77	.04
Teacher's PD (Main predictors)						
PD hours in curriculum	35	7.94	10.51	0.00	55.00	.30
PD hours in assessment	37	5.89	6.71	0.00	25.00	.26
Intensity of mentoring/coaching T/TA	43	2.79	1.45	1.00	5.00	0
Did not receive T/TA	18 (42.9%)					
Received T/TA	11 (26.2%)					
Do not know if received T/TA	13 (31%)					
Years of experience	44	14.80	8.6	1.00	30.00	.07
Highest degree						
Less than BA degree	8 (18.2%)					
Ba degree	21 (46.7%)					
Higher than BA degree	15 (34.1%)					
Field of highest degree is ECE/CD	21 (58.3%)					
Classroom-level control variables (for RQ1 and 2)						
Class Size	**45**	**15.15**	**2.77**	**7.00**	**20.00**	**.46**
Child/Adult Ratio	45	5.87	2.00	2.3	9.75	.08
Level-2 Descriptive Statistics (Center/Director) Directors as main predictors and moderators						
Variable Name	**N**	**Mean**	**Sd**	**Min**	**Max**	**Cohen's D**
PD participation in the last year	41	2.48	1.67	0.00	6.00	.01
Perceived management challenges	41	1.79	0.41	1.09	2.64	.13
Teacher related workload	41	2.30	.64	1.00	3.75	.43
Years of experience	41	10.12	8.36	0.00	30.00	.07
Highest degree						
Less than BA degree	5 (11.9%)					
BA degree	18 (42.9%)					
Higher than BA degree	19 (45.2%)					
Field of highest degree is ECE/CD	18 (43.9%)					
Center-level control variable (for all questions)						
Number of lead teachers in the center	42	1.62	2.24	0.00	15.00	.89